ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

October 2021



DISCLAIMER

This report has been prepared based on the Project information available to NESPAK & EMC. The teams at NESPAK and EMC are not responsible for control over the changes in the Project design data which may require update of this report in future.

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Malir Expressway Project (MEX)

Environmental Impact Assessment (EIA) Report

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LIST OF ABBREVIATONS

AASHTO	American Association of State Highway and Transportation Officials
AIP	Access Information Policy
AOI	Area of Influence
APs	Affected Persons
ASTM	American Society for Testing and Materials
CCI	Council of Common Interest
CCMP	Construction Camp Management Plan
CDA	Canal and Drainage Act
CDM	Clean Development Mechanisms
CEO	Chief Executive Officer
CITES	Convention on International Trade in Endangered Species
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COI	Corridor of Impact
COP	Conference of Parties
CSC	Construction Supervision Consultant
dB(A)	decibels
DMCs	Developing Member Countries
DPs	Displaced Persons
ECO	Economic Cooperation Organization
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPRP	Emergency Preparedness and Response Plan
ESMS	Environmental and Social Management System
FAO	Food and Agriculture Organization
GHG	Green House Gas
GoS	Government of Sindh
GRC	Grievance Redressal Committee
GRM	Grievance Redress Mechanism
HSE	Health, Safety and Environment
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IP	Indigenous Peoples
IR	Involuntary Resettlement
IUCN	International Union for Conservation of Nature
KMC	Karachi Metropolitan Cooperation
LAA	Land Acquisition Act
LAC	Land Acquisition Collector
LARPs	Land Acquisition and Resettlement Plans
LDCs	Less Developed Countries
AMSL	Above Mean Sea Level
MEX	Malir Expressway
MSDS	Material Safety Data Sheets
NESPAK	National Engineering Services Pakistan (Pvt.) Limited
NGOs.	Non-Governmental Organization
NHA	National Highway Authority
NOC	No Objection Certificate

NPO	No Project Option
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
OIC	Organization of the Islamic Cooperation
P&D	Planning &Development
PD	Project Director
PDMAs	Provincial Disaster Management Authorities
PGA	Peak Ground Acceleration
POPs	Persistent Organic Pollutants
PPEs	Personal Protective Equipment
PPP	Public Private Partnership
PSF	Partnership Support Facility
RNR	Renewable Natural Resources
ROW	Right of Way
SAARC	South Asian Association for Regional Cooperation
SAEMR	Semi-Annual Environmental Monitoring Report
SBC	Seismic Building Code
SC	Supervision Consultant
SDGs	Sustainable Development Goals
SEPA	Sindh Environmental Protection Agency
SEQS	Sindh Environmental Quality Standards
SLGA	Sindh Local Government Act
SMP	Social Management Plan
SN	Structural Number
SOP	Standard Operating Procedures
SPS	Safeguard Policy Statement
SSSD	Sustainable Development
SSWMB	Sindh Solid Waste Management Board
TMP	Traffic Management Plan
ToR	Terms of Reference
UNCED	UN Conference on Environment and Development
UNFCCC	UN Framework Convention on Climate Change
UNO	United Nations Organization
USEPA	United States Environmental Protection Agency
VGF’	Viability Gap Fund
WHO	World Health Organization

UNIT CONVERSION

1 Acre	4,046.86 Square Meter (m^2)
1 Hector (Ha)	10,000 Square Meter (m^2)
1 Hours (hr)	3,600 Seconds (sec), 60 Minutes (min)
1 Kilo Meter (km)	1,000 Meter (m)
1 Kilometer per Hour (kph)	0.2778 Meter per Seconds (mps)
1 Tones (T)	907.185 Kilogram (Kg)

EXECUTIVE SUMMARY

A. INTRODUCTION

1. The Company "Malir Expressway (Private) Limited", has been given the responsibility of developing and executing the Malir Expressway Project, where after finalizing design, Right of Way (RoW) and various other technical parameters, the company now requires the approval of the Sindh Environmental Protection Agency before any construction activities may be commenced. For this, the company has engaged National Engineering Services Pakistan (NESPAK) and EMC Pakistan (Private) Limited to study the project in detail and carry out the Environmental Impact Assessment to ascertain impacts that may arise during the different stages of activity (pre-construction, construction, and operation) and advise appropriate mitigation measures, which on implementation will ameliorate the effects from these impacts.

2. The objective of the proposed Malir Expressway (MEX) is to improve the traffic flow in this stretch by providing a 6-lane all weather road of International Highway Standards of geometrics, strength and durability of road and cross drainage structures like bridges and culverts. The proposed MEX start before Jam Sadiq Bridge on Korangi Road which is on Right Bank of Malir River and travels along the Malir River up to the existing Link Road between N-5 and M-9 (2.4 km short of M-9), takes left turn from this point to meet M-9 (Kathor), the end point of the Project. The measured length of the expressway is 38.750 km with 6-lane dual access controlled carriageway. The proposed Project includes six (06) interchanges and will pass through Malir and Korangi Districts of Karachi City of Sindh province. The Project location map is shown in **Figure 1.1**.

3. The prime objective of the EIA study is to fully meet the statutory requirements set forth by the Sindh Environmental Protection Act - 2014 to facilitate decision making by the Sindh Environmental Protection Agency (SEPA).

4. The SEPA (Environmental Assessment) Regulations, 2021 provides screening categories for the different type of environmental assessment that needs to be carried out for different projects, i.e., a Checklist, IEE, or EIA. The proposed MEX falls under the requirement for an EIA, namely: **Schedule (III) – Projects Requiring an EIA**: Category (E) – Transport: *Subcategory (2) – Construction of highway, motorways, major roads (Intercity roads) more than one km and above*. This defines the specific category of projects which this proposed project falls into and hence, requires an in-depth Environmental Impact Assessment to be carried out and submitted to the Sindh Environmental Protection Agency for their scrutiny and approval process.

5. Based on the above provincial requirements, an EIA of the proposed Project has been prepared.

B. EIA METHODOLOGY

6. The methodology adopted to prepare the EIA is in accordance with Sindh Environmental Protection Agency's IEE/EIA Regulations, 2021. The methodology included the desktop

studies, delineation of the CoI and RoW, carrying out field surveys for baseline conditions, analysis of alternatives, stakeholder consultations, impact assessment and the preparation of Environmental Management Plan (EMP).

C. DESCRIPTION OF THE PROJECT

7. The MEX design envisages a six-lane dual carriageway. The approximate length of the Project is 38.75 km. Geometric design of the Project has been developed for a speed of 100 km/hr. The design of curves is compatible for the adopted design speeds and Geometric Standards as laid by American Association of State Highway and Transportation Officials (AASHTO) 2004. The proposed Project is located in District Malir and Korangi of Karachi City of Sindh province which can be easily accessible through major roads such as Motorway (M9) - National Highway (N5) Link Road, Dumlottee Road, Malir River Road, Malir Dam Road, Malir Cantt Road, National Highway-Super Highway Link Road, Malir – Shah Latif Town Road, Sommo Goth Road, Malir River Bridge Road, Korangi Link Road, Korangi - Shah Faisal Road, Malir Right Bank Road, EMB Causeway, Shaheed-e-Milat Expressway and Korangi Road near KPT Interchange.

8. The proposed Project also includes five (05) interchange with toll collection arrangements, two (02) flyovers, four (04) cross drainage bridges, four (04) underpasses, eight (08) cattle and thirty one (31) cross drainage culverts. The estimated total cost of proposed MEX is about PKR 27.5 Billion. The Project is scheduled to be completed in thirty (30) months. Construction activities involve earth work (clearing of vegetation/ trees and top soil), roadwork (levelling, preparation of sub grade, sub base, base and wearing course) and structure works.

D. PROJECT ALTERNATIVES

a) No Project Option (NPO)

9. This rapid increase in population has put a lot of pressure on the city's infrastructure especially the Urban Transport System (UTS) which is not -yet organized in a modern manner, and therefore barely caters to the mobility needs of the mega city. At present, Karachi has three main corridors linking it to rest of the country namely:

- The Karachi – Hyderabad Motorway (M-9) (Superhighway) / Shahrah-e-Pakistan corridor;
- The National Highway N-5 / Shahra-e-Faisal corridor and the RCD Highway; and
- N-25 / Hub River Road Corridor.

10. However, upon entering the urban limits these corridors become highly congested due to the increasing volume of internal traffic in the city with a substantial volume of light vehicles and public transport vehicles besides the frequent pedestrian movements across the roads conflicting with smooth & uninterrupted flow of traffic. Considering this scenario, 'No Project Option' will result in further worsening of the present traffic conditions, environmental, social and economic implications to the road users of Karachi City. Furthermore, the Karachi Master Plan 2020 has already recognized the ring road

concepts in Karachi thereby creating an opportunity to bypass the congested radially oriented road system.

b) Comparison of Widening of Existing Roads to Access the Required Destinations and Construction of New Malir Expressway

11. The major business as well as residential areas of the Karachi such as Karachi Port, Industrial areas of Landhi and Korangi, between the CBD area, Clifton and DHA (Phase 1 to 8) and the proposed DHA City & the Education City can be accessed through existing roads such as Korangi Road, EBM Causeway Link, National Highway (N-5) near Quaidabad, Link Road between N-5 and M-9 and finally the Motorway (M-9) at the end point.

12. The competitive routes and relative distance savings via Malir Expressway for the same origins and destinations i.e., for trips between the Southern parts of the city in the vicinity of Karachi Port, DHA and Clifton, etc. and the North Eastern parts i.e., DHA City, Bahria Town, the Karachi – Hyderabad Motorway (M-9) for onwards journey up-country. The widening of these roads is not feasible option due to the major commercial centres, housing societies, educational institutions and health facilities along these roads which cause major land acquisition and resettlement issues and social as well as environmental disturbances.

13. Considering the above scenarios, Malir expressway will cause least environmental and social damages due to lesser travel distance and time and limited land acquisition and resettlement issues. This expressway will also provide a natural bund (due to embankments) to the seasonal urban floods in heavy monsoon rains. Due to these reasons, this MEX Project is much environmentally and socially feasible and economically viable.

c) Route Alternative of MEX

14. Two (02) options have been considered for proposed MEX “Option A” and “Option B”. A team of experts followed the route ‘Option A’ for the purpose of route optimization by making physical, ecological, social and design observations at the site. Based on the route optimization survey, a comparison matrix was prepared considering the length of the MEX route, terrain, construction, operation and maintenance, environmental and resettlement issues, etc. Keeping in view all merits and demerits of the MEX Options A and B, the Option B was finalized and will cause least environmental and social damages due to lesser travel distance and time and limited land acquisition and resettlement issues.

d) Construction Camp Site Alternatives

15. The team has identified a total of four (04) construction campsites along the MEX, which were further assessed by the environment team by considering the construction camp selection criteria described in Chapter 4. Based on the comparative assessment, three (03) construction camps were finalized which have better access to the main / link roads

and no resettlement issues are involved. Contractor may choose any of the proposed construction camp location in consultation with the Supervision Consultant and Concessionaire by considering environmental constraints as mentioned above.

E. BASELINE OF PROJECT AREA

16. Considering the potential impacts of the proposed Project, existing baseline environmental conditions of the proposed Project's RoW (50 meter from the centre line on both side RoW) has to be used as a benchmark for comparison of the physical, ecological and socio-economic conditions before and after construction phases of the Project. This baseline will also provide the datum for assessing the potential impacts and proposing the required mitigation measures, which will be implemented effectively at various phases of the Project activities.

17. The data presented in the baseline section has been collected from primary and secondary sources. For the primary data acquisition, the NESPAK team conducted the reconnaissance and detailed field visits. EIA team conducted a detailed field visit to the proposed Project site.

a) Physical Environment

18. The proposed Project is located in Karachi, the south of Sindh. The terrain morphology along the proposed route comprises predominantly flat with small sections of ridges and slopes in Malir and Korangi Districts. The highest elevation along the proposed MEX is about 100 meters above mean sea level (amsl) and the lowest is 05 meter amsl.

19. The geology of the proposed Project area falls under HOLOCENE surficial deposits comprises of unconsolidated deposits of clay, gravel and morains and MIOCENE ROCK Gaj Formation comprises of mainly marine shales and limestone, fossiliferous, topmost sandstone and shales estuarine with abundant molluscan and few vertebrate fauna, early miocene.

20. The proposed Project is located in the seismic-tectonic region where a moderate level of seismic activity is believed to exist, but large magnitude earthquakes are rare. The Building Code of Pakistan places Karachi in Zone 2B, which corresponds to peak ground acceleration value of 0.16g to 0.24g.

21. Groundwater resources in proposed Project Area are limited. Small amount of groundwater is extracted for private use. The groundwater aquifers at the start of the proposed Project alignment i.e. close to the coastal belt are mostly saline and unusable for domestic purposes. The aquifers are estimated to lie at depths of 50-100 meter. Malir River is the major surface water body of the Study Area which is seasonal and passes through the city of Karachi from North East to the Centre and drains into the Arabian Sea.

22. The proposed Project Area is located just above the tropical zone on the coast of the Arabian Sea at 24º45" to 25º15" north, and 66º37" to 67º37" east at about 20 meter above sea level (Karachi airport weather station). The climate of the Project Area is

characterized by dry, hot and humid conditions and in general terms it is moderate, sunny and humid. There is a minor seasonal intervention of a mild winter from mid-December to mid- February followed by a long hot and humid summer extending from April to September, with monsoon rains from July to mid- September. The level of precipitation is low for most of the year. Project Area also receives the monsoon rains from July to September. The humidity levels usually remain high from March to November, while very low in winter as the wind direction in winter is North Easterly.

23. Total five (05) points have been selected for ambient air and noise monitoring at site. The work for external monitoring and testing was awarded to SEPA approved environmental laboratory. The surface water sampling was carried out at three (03) points and ground water sampling was carried out at two (02) points.

b) Ecological Environment

24. In order to study the Project Area, all available literature, and data regarding the tract, its habitat, flora and fauna was thoroughly reviewed to have a better understanding of the Project Area. After going through all available material a check list was developed, on the basis of which the baseline data was collected.

25. The Integrated Biodiversity Assessment Tool (IBAT) was utilized to carry out the initial ecological based screening of the area. The information/data of IBAT was further refined and verified by utilization of various tools including literature review, stakeholders/departmental consultations and random ground trothing. Based on the investigations, there are no species of conservation importance, endemic species, endangered, critically endangered etc. present in the vicinity of Project Area (CoI).

26. The Project Area falls in tropical thorn forests with degraded status of indigenous biodiversity. The ecological zone is included in Indus eco region which covers about 65% of the land area of Sindh Province. As the climatic conditions are harsh, it is difficult for the natural environments to survive under these unfavorable conditions, which are further augmented by drought and land clearance activities on account of rapid urbanization. As a result, vegetation is sparse and scanty.

27. Major crops grown in the area include wheat and fodder during winter, and vegetables and fodders in summer. No significant horticulture practices were reported except few of guava, papita and lemon gardens were observed. Some sporadic trees of Date Palm, Coconut and Jaman have been reported in the study area.

28. In the Project Area Neem (*Azadirachta indica*), Pilkhan (*Ficus virens*), Jungle jalebi (*Pithecellobium dulce*), Karir (*Capparis decidua/aphylia*), Babul (*Acacia nilotica*), etc. are the main floral species. Among the wild animals which includes jackal, fox, porcupine, common mongoose, and hedgehog. A variety of mammals, reptiles, amphibians and bird species reported in the CoI mentioned in Chapter 5.

29. Based on the comprehensive assessment on the aquatic ecology through review of the baseline literature, detailed survey of the Project Area and discussions with the inland and coastal areas Fisheries Department Sindh. There are two types of fish species i.e. Tilapia (Oreochromis mossambicus) and Channa punctate reported during the site survey and also during the consultation with the Office of Director Marine Fisheries.

c) Socio-Economic Environment

30. A sample of 240 respondents including (males & females) was taken from different villages/settlements (Shah Faisal Colony, Sommo Goth, Shafee Goth, Magsi Goth, Bachal Goth, Memon Goth, Dumlottee, etc.) of two districts (Korangi and Malir districts) depending on the proportion of route of the road passing in the areas on the basis of random sampling technique, which included local residents, Farmers, shop keepers, pedestrians, drivers, hospital management, Govt employees, Imam Mosque etc. During the survey it was observed that mosques are available in the almost all large and small settlement in the Project Area even a few numbers of shrines were also reported by people. Moreover, Hindu community is also settled in the area they have built small Mundars at their houses for the worship.

F. POTENTIAL IMPACTS AND MITIGATION MEASURES

31. In broader spectrum, the Project activities could be categorized in the following three phases: 1) Planning & Design phase; 2) Implementation & Construction phase; and 3) Operations & Maintenance phase for the proposed MEX Project. Phase-wise summary of adverse potential impacts due to proposed Project is given in **Table ES-1**

Table ES-1: Potential Impacts and Their Applicable Mitigation Measures

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
Preconstruction / Design Phase					
1	**Permanent Land Acquisition** The proposed MEX will be constructed on an alignment for which land acquisition will need to be carried out.	Compensation should be made to the affected people as per Land Acquisition Act, 1894. Adequate budget will be provided in the Project cost for this compensation. Land Acquisition and Resettlement Plan (LARP) should be prepared for the acquisition and compensation strategies as per National and Provincial laws.	• Compensation and land acquisition records • Implementation record of LARP	District Government Malir and Korangi	Proponent
2	**Renting/Leasing Land** The development of Contractor camps and facilities i.e. storage, workshops, equipment parking and washing areas; aggregate quarries; and access roads/tracks for haulage, transportation etc. will required renting/leasing land.	Land for above mentioned facilities will be directly rented from the private landowners by the Contractors. Rental terms should be negotiated to the satisfaction of the concerned landowners and the agreement should be in local language to make the process clear. Mitigation mentioned in Section 7.6.1.2.	• Compensation and land lease records	District Government Malir and Korangi	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
4	**Loss of Agriculture Land** Due to the proposed Project, agricultural land, where Lucerne, vegetables and fodders are cultivated, will be affected and crop yield will be disturbed.	• Agricultural Land that will be coming under ROW should be acquired as per market rates which will be defined in LARP of the proposed Project.	• Confirmation of design incorporation. • Compensation records • Audits and Checks	District Government Malir and Korangi	Proponent
5	**Flora** During the pre-construction phase, activities such as installation of construction camps, construction of temporary roads & mobility of construction staff may damage the local vegetation/trees.	• The camps, mobility of machinery and construction of temporary road should be properly planned and well designed to avoid any loss to local green cover. • A tree plantation program shall be formulated with the recommendations and technical support of concerned Agriculture and Forest Department.	• Conformation of design incorporation • Checks and audits of suitable place • Tree compensation record	CC, Design Consultant	Proponent
6	**Change in Hydrologic Regime** The proposed road will cross four (04) numbers of nullahs (including one main tributary of	For the crossing of nullahs, drains and other structures, box culverts, pipe culverts and bridges will be constructed.	• Confirmation of design incorporation. • Audits and Checks	CC, Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Malir River near RD 34+200), numbers of sewerage and storm water drainage outlets/network There might be change in water flow pattern and disturbance to water flow occurred which will cause impact on downstream of these water bodies.				
7	**Public Utilities** Public utilities will be affected and creating disruption of public services and inconvenience to the local residents due to proposed MEX. Various utilities such as electrical poles of 11kV transmission lines, telephone lines and tube-wells /wells are situated within the CoI of the proposed MEX. The proposed road will cross High Voltage transmission lines (220 kV and 500 kV) at RD 00+250, 00+625 12+400, and 25+750 locations. These utilities will be relocated before the start of construction activities. These utilities if not handled properly will cause	• Proper compensation and restoration mechanism of public utilities will be considered. • Close coordination with the concerned departments to curtail inconvenience to the residents of the Project Area. • Timely public notification of unexpected disruption of services. • Mitigation mentioned in Section 7.6.1.7 shall be followed.	• Confirmation of design incorporation. • Work order issuance after prior meeting and issuance of prior notification to public and concerned department. • Audits and Checks	CC, Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	difficulties to the peoples of Project Area				
8	**Resource Conservation** Resources involved in the construction of proposed Project would include water, fuel and construction materials. Excessive water consumption, non-renewable construction material, and fuel for energy will cause stress on these resources.	• A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels. • The efficient and well maintained equipment and machinery should be used; • Reuse of construction waste materials may be adopted wherever possible; Mitigation mentioned in Section 7.6.1.9 shall be followed.	• Confirmation of design incorporation. • Audits and Checks	CC, Design Consultant	Proponent
9	**Seismicity** The Project Area is located in Seismic Zone 2B, where 2B (upper limit of moderate damage) represents peak horizontal ground acceleration from 0.16 to 0.24 g.	The proposed road and the associated structures should be designed and constructed as per Seismic Building Code of Pakistan 2007 (SBC-07) to comply with minimum requirements for seismic safety of structures.	• Confirmation of design incorporation. • Audits and Checks	CC, Design Consultant	Proponent
10	**Fauna** As movement and installations of machinery and vehicles will take place so noise and habitat loss is expected.	• The standard measures must be adopted to minimize noise due to machinery movements and installations. • Wildlife movements and routes must be considered during activities	• Confirmation of design incorporation • Checks and audits of suitable place	CC, Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements and installations.	and should be avoided to their maximum level. • The camps shall be properly fenced and gated to check the entry of animals in search of eatable goods.			
Construction Phase					
1	**Temporary Access Roads** The proposed MEX is approachable through major roads as mentioned in Section 7.6.2.1. Apart from above existing road, few accessibility tracks needs be developed which may cause damage to trees and crops, soil erosion, soil contamination, air and noise problems.	• According to usual practices during the construction of road, the access road will be developed within the RoW of the proposed road. Mitigation mentioned in Section 7.6.2.1 will be followed.	• Regular observation and photographic record of transportation route, • Road/track repair records, • Compensation records for damages of crop, trees and other infrastructure (if happens)	CC	Proponent
2	**Traffic Management** Due to the proposed construction activities and movement of heavy Project vehicles for construction material supply; traffic problems may arise for the commuters	• Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime. • Traffic Management Plan will be implemented to avoid traffic accidents, jams/public inconvenience.	• Vehicle maintenance record • Training record • Implementation of TMP • Regular visual observations	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	and transporters travelling to the proposed areas. The movement of vehicles along the haulage routes will cause soil erosion, debris flow, dust emissions etc.	Mitigation mentioned in Section 7.6.2.2 shall be followed			
3	**Community Health and Safety** The construction activities and vehicular movement at construction sites may result in roadside accidents deteriorate quality of groundwater and surface water resources, cause air/dust emissions, noise pollution, vibrational impact and spread of different transmittable diseases due to outside labour	Proper control on construction activities, restrict entry of labors with different transmittable diseases, adopt mitigations for dust, noise & vibration impacts and create awareness about road safety will be ensured. Mitigations mentioned in section 7.6.2.3 will be adopted.	• Implementation of HSE Plan • Use of PPEs • Community concerns record • Medical reports of worker	CC	Proponent
4	**Occupational Health and Safety** Occurrence of accidents / incidents and other natural emergencies during the construction stage is a common phenomenon and workers as well as locals will be more prone to serious accidents.	Safety precautions for the construction workers, Training of workers in construction safety procedures and use of Personnel Protective Equipment (PPE) will mitigate this impact. Mitigations mentioned in section 7.6.2.4 will be adopted.	• Implementation of HSE Plan • Use of PPEs • Training Records • Work permits • Implementation of Emergency response plan and disaster management plan in	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
			case of natural disaster occurrence		
5	**GHG Abatement** The main sources of greenhouse gases (CO_2, CH_4, NOx etc.) during the construction activities of the proposed Project will include both mobile and stationary sources. Emission of greenhouse gases cause global warming and other climatic changes on regional and global scale.	SEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works. Alternative energy resources shall be considered where possible. Plantation development as per the tree plantation/reforestation plan is highly recommended for the sequestration of CO_2 and vehicle maintenance protocol will be adopted.	• Regular environmental monitoring, sampling and testing reports • Vehicle inspection record • Plantation record	CC	Proponent
6	**Ambient Air Quality** Airborne dust from access road construction and use, wind erosion of material stockpiles, emissions from diesel vehicles and construction equipment, disposal of waste have potential to adverse impact sensitive receptors in the Project Area.	• The following effective measures need to be adopted for controlling the potential adverse impacts on ambient air quality: • The existing quarries will be used to borrow the aggregate materials; • Concrete batching plants will be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce the level of dust emissions; • Ensure the proper and periodic tuning of the vehicles; • Dust emissions from trucks will be reduced by a regular sprinkling of	• Visual observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records • Water sprinkling records.	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		water for keeping the dust settled at least twice a day; • Haul-trucks carrying sand aggregate and other materials will be kept covered with tarpaulin to reduce the dust pollution; • Turn off the engines for all vehicles, while parked on the site; Regular monitoring of air quality in accordance with SEQS.			
7	**Noise and Vibration** Noise and vibration generated by the construction machinery during the construction stage is likely to affect the CoI particularly the sensitive receptors like nearby schools, houses and settlements etc.	• There are a variety of ways by which construction equipment and worksite noise can be controlled. Mitigations mentioned in section 7.6.2.7 shall be adopted.	• Physical observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records	CC	Proponent
8	**Soil Erosion** Construction activities such as clearing of earth, levelling, compaction, carpeting, pavement finishing will affect the existing soil condition in the CoI. Soil erosion may also occur in the workshop areas as a result	Good engineering practices will help to control or minimize the soil erosion both at the construction sites and in peripheral areas. All the disturbed areas need to be protected against soil erosion by stripping and stockpiling of all the available topsoil for later re-vegetation. Special slope protection	• Visual observation and photographic record • Site restoration and rehabilitation plan implementation	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	of improper drainage system of equipment washing-yards and improper management of construction activities.	measures will be adopted in the sensitive areas and along the shoulders of roads. Site restoration plan for the Project will be strictly followed.			
9	**Soil Contamination** Land may be contaminated due to the spillage of chemicals, fuels, solvents, oils, paints, concrete, solid waste generated at campsites etc. This normally happens when these materials are transported in open or loosely capped containers. The possible contamination of soil by oils and chemicals at camp sites, workshop area and equipment washing-yards may limit the future use of land for agricultural purposes.	• The Contractors will be required to instruct and train their workforce in the storage handling and management of materials and chemicals that can potentially cause soil contamination; • Material Safety Data Sheets (MSDS) will be strictly followed during handling and storage of chemicals; • Soil contamination due to concrete transportation and solid waste will be minimized by placing all containers in casings; and	• Visual observation and photographic record • Waste Management plan implementation	CC	Proponent
10	**Wastewater Generation at Construction Camps** Wastewater will be generated at the construction camps (total 03 in Nos. and from construction activities. Based on the estimated, 28,800 liters/day	• To dispose the liquid waste generated from the construction activities, the following steps will be taken by the Contractor: • Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic	• Visual observation • Regular environmental monitoring, sampling and testing reports • Waste Management plan implementation	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	wastewater will be generated from camps during the construction phase which may affect water bodies if disposed off without proper treatment.	tanks (as shown in Figure 7-9). Proper monitoring to check the compliance of SEQS will be carried out; and • Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit.			
11	**Solid Waste Generation at Construction Camps** Considering the labourers (about 900 Nos.) residing in the construction camp and the locally available labour, a total of about 450 kg of solid waste will be generated from the construction camp daily. The major components of the labour camp waste will be garbage, putrescible waste, rubbish and small portion of ashes and residues. Other type of wastes may include inorganic construction wastes.	• All the solid waste from the camps will be properly collected at source and disposed of through proper solid waste management system. The Contractor will coordinate with local representatives and administration concerned department for the disposal of solid waste; • The concerned department must develop a plan of action for transporting the waste to the disposal site for final disposal. It is the responsibility of the concerned department to ensure that the disposal site is properly lined to prevent the leachate from contaminating the groundwater; • Secondly, the disposal site must be located away as far as practical from populated areas and regions that have a high density of Wildlife;	• Visual observation and photographic record. • Waste Management plan implementation	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		• Toxic waste will be handled, stored, transported and disposed separately through SEPA certified contractors; • The waste will be properly sealed in containers with proper labels indicating the nature of the waste; and • Solid waste will be segregated at source so that it can be re-used or recycled.			
12	**Waste Generation at Construction Site** The construction waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials etc.). The handling and storage of oil and other hazardous waste will be a source of environmental pollution during the excavation, foundation, levelling, carpeting and pavement activities.	• Waste Management Plan will be developed to implement an efficient and responsive solid waste management system during construction phase.	• Visual observation and photographic record. • Waste Management plan implementation	CC	Proponent
13	**Borrow Pits** Borrow pits and its excavation activities may result in land	• Necessary permits will be obtained for any borrow pits from the competent authorities.	• Visual observation and photographic record	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments. Borrow pits may also become potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife. This will also degrade hygienic condition of the Project Area.	• In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4; • Soil erosion along the borrow pit will be regularly checked to prevent/ mitigate impacts on adjacent lands; • In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and Borrow pits will be used for construction waste, but during the excavation, top 20 cm soil cover will be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area.	• NOC record of permits • Check and audits		
14	**Impact on Water Resources (Surface and Groundwater Contamination)** The proposed MEX will also cross the numbers of nullahs and drains at different locations. The bridges and culverts are proposed on these water resources these surface water resources may get contaminated by the fuel and chemical spills, or by solid waste	As a mandatory step, all the effluents will be disposed as per the requirements of SEQS. Moreover, to reduce the risk of surface and groundwater contamination, good management practices will be adopted to ensure that fuels, chemicals, raw sewage and wastewater effluent are disposed of in a controlled manner. Mitigations mentioned in section 7.7.2.14 shall be adopted.	• Visual observation • Regular environmental monitoring, sampling and testing reports • Waste Management plan implementation	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	and effluents generated by the kitchens and toilets at the construction camp sites. Moreover, runoff from the chemical storage areas may also contaminate the surface water bodies.				
15	**Flora** The Project will involve destruction of vegetation cover on construction areas particularly along proposed road construction.	• Cutting of trees and disturbance of orchards shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized and possible alternate route must be considered for proposed road, in which minimum ecological and environmental losses are expected. • A tree plantation program shall be formulated with the recommendations and technical support of concerned Agriculture and Forest Department.	• Tree compensation record • Visual observations • Regular monitoring, audit and checks	CC	Proponent
16	**Fauna** During construction phase the existing population of mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving	• Care shall be taken during construction activities for avoiding purposely or chance killing of animals. • If found any wild species and habitat during construing that must dealt carefully and local wildlife	• Departmental consultation record • Visual observations • Regular monitoring, audit and checks	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	excavation, blasting, movement of machinery and vehicular traffic, movement of labor, camping, etc.	department officials should be called. • Special measures should be adopted to minimize impacts on birds such as avoiding noise generating activities during the critical period of breeding. • Hunting, poaching and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labor force accordingly and clear orders should be given in this regard.			
19	**Aquatic Fauna** There is no direct impact on fish in the Project Area as there is no fish reported in the Project Area.	• Proper arrangements must be made to control the wastes from machinery & equipment used at site during the construction phase.	• Departmental consultation record • Visual observations • Regular monitoring, audit and checks	CC	Proponent
20	**Social Impacts** • Social and Cultural Conflicts;	• Local labor especially from nearby communities should be given preference for the construction works; • Careful planning and training of work force to minimize disturbance to the local people; • Public notification through print or electronic media during the entire construction phase to avoid any	• Record register of all the issues and rational expectations desired by the local public; • Camp established away from the nearest community; Local hired workforce;	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	• Health Impacts (Communicable Diseases)	inconvenience in accessibility to the locals; and • Adequate training of especially for the transitive workforce of the station (involved both in the construction process and in the commissioning) to regard the customs of the area so that the locals do not feel insecure. • Proper check-up of skilled and unskilled workers before their hiring; • Labour camp should be away from the residential area and workers' management plan should be formulated by Contractor to minimize the adverse impacts on local communities and workers; • Trainings, awareness and campaigns should be conducted for workers and surrounding communities on awareness and prevention of HIV/AIDs and COVID-19; • Workers should be educated for personal hygiene and the sanitation concerns, leading to communicable and non-communicable diseases; • Water should not be allowed to stagnate even if clean, and	• Any complaint from the local community. • Approved OHS Plan, evidence of OHS trainings conducted. Accident/Incident reported. • Training records Health and safety manual • Contractor will implement the SOPs related to the Construction industry. • Health and safety manual.		

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		measures should be taken to cover the area; and • Insecticides should be periodically sprayed.			
21	**Influx of Labor** Social problems and conflicts that are associated with Labor Influx are Risk of social conflict, Increased risk of illegitimate behavior and crime, Impacts on community dynamics, Local inflation of prices, accommodations and rents, Increase in traffic and related accidents, etc.	• Labor camp(s) should be established away from residential population; • Preference should be given to the local people to work with contractor, and contractor should hire maximum labour force from the Project Area because this will reduce the labour influx; • An effective GRM should be established for the Project to resolve all issues related to the community. Thus, progress regarding resolving the issues should be monitored closely; • Mitigations mentioned in section 7.6.2.21 shall be adopted.	• Minutes of meetings of community Consultation Dissemination relevant material.	CC	Proponent
22	**Religious, Cultural, Historical Sites** No notified religious, archaeological, cultural and historical sites are located within the CoI including RoW of the proposed MEX. Hence, insignificant impact on the	• No notified archaeological site will be affected due to the implementation of the proposed Project. However, the Contractors will be required to train the construction crews and the site supervisors in archaeological site recognition, conservation procedures and temporary site protection.	• Record Register • Consultation record of Archaeological Department	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	notified archaeological site has been assessed during the construction of the proposed Project.	• In case of a chance archaeological find during excavation, the Contractors must halt work at the site immediately and notify the Department of Archaeology and Museums through Project Director.			
23	**Gender Based Violence (GBV)** The Project route is passing through the urban and semi urban areas where women are involved in working activities. During construction phase gender based violence might arise due to discrimination made against women by unequal work distribution and unequal pay structure among others. Sexual harassment against women might occur as a consequence of mixing of men and women at the construction site, and moving on the roads, bus stops and markets. Educational institutions near the Project alignment are also sensitive regarding gender issues.	• Awareness should be created among the females at individual and community levels about the constructions sights; • The Contractor should make sure that no discrimination is made on the basis of gender while hiring of workers; • Raise awareness among the communities of the potential risks of GBV, and establish response services in the communities that can respond to instances of GBV (particularly those related to issues of labour influx); • Contractor should take proper measures to address and resolve issues relating to harassment, intimidation, and exploitation, especially in relation to women.	• Grievance redress record • Minutes of meetings of community/ gender consultation	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
24	**Child Labor** Inhabitants of the Project Area have mix economic background and different sources of income. Children of low income groups mostly involve in different earning activities, as their parents prefer to get their children hired in small shops as helpers, and waiters in hotels for earning money, and supporting household livelihoods.	• Awareness should be created among the local communities about the adverse impacts of child labor. • Contractor through contractual agreement should be bound to follow the labor standards, rules and regulations during hiring the labor force and all activities should be monitored by the social and environmental staff of the implementing agency; • Contractor should ensure the presence of all persons at site are adults and have their proper identity cards with them.	• Compensation record. • Grievance redress record	CC	Proponent
Operation and Maintenance Phase					
1	**Air Quality** Improvement in road condition will help reduce traffic related emissions in the short term by allowing a smoother traffic flow. It is positive in case of improvement	• Proponent with the help of SEPA may set up system to monitor air quality along Project Area in accordance with SEQS for a specific period to record the quality of air during the operation phase. • Mitigations mentioned in section 7.6.3.1 shall be adopted.	• Visual observation • Regular environmental monitoring, sampling and testing reports.	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	of road conditions; and minor negative, when traffic volume increases. Air Modelling was carried out by using CALROAD to assess the impact which is discussed in Chapter 7.				
2	**GHG Emissions** Vehicle traffic on the proposed expressway alignment will result in emissions of GHG from fuel combustion during the operation phase. Total GHG emissions from the MEX traffic is 13,740 tCO_2e/day and 59,118 tCO_2e/day for 1st and 20th year of proposed traffic respectively. As this traffic is diverted from the other routes of the Karachi, therefore, the emissions are not considered to be substantive and are not likely to result in overall Change in GHG Emissions of whole city / project area / surroundings. If anything, this will lead to lesser traffic congestion and traffic jams	• Mitigation of air quality and traffic management will help to mitigate the impact of GHG emissions.	• Visual observation • Regular environmental monitoring, sampling and testing reports.	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	where cars produce more emissions.				
3	**Noise and Vibration** Noise and vibration not expected to be as great as they are in the case of traffic congestion in the city.	• Provision of adequate noise barriers such as hedges and indigenous tree species will reduce the noise. Further Improvement can be made by enforcing the laws and getting the vehicles tested, regularly after a specific time period, by some reputable vehicle testing laboratory and obtaining a certificate. • Mitigations mentioned in section 7.6.3.3 shall be adopted.	• Physical observation • Regular environmental monitoring, sampling and testing reports.	Proponent	
4	**Road Safety** Enhanced vehicular movement and speed in the long run may result in road safety issues like traffic accidents. This impact is permanent but moderately adverse in nature, since the frequency of accidents may be lowered, but their intensity may be quite severe due to enhanced speeds at which vehicles will move.	• Strict enforcement of speed limits, installation of speed guns and channelization of traffic with respect to categories (heavy vehicle traffic and light vehicle traffic), should be ensured for the smooth flow of traffic moving from major road crossings. Enforcement of penalties for the violators will reduce the significance of this impact.	• Road safety enforcement record • Challan / penalties record • Accident record • Audits and check regularly	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
5	**Drainage** During the operational phase, poor maintenance of the road drainage system, particularly during the monsoon season can cause nuisance to the travelers and public due to flooding in the existing drainage line. In case of chocking of road drainage, the increased surface runoff due to heavy rains will accumulate at the start and end point of the proposed MEX and can cause traffic jams.	• The impact can be controlled/reduced by timely and continuous maintenance/ cleaning of the drainage system; and • Placement of sign boards instructing not to dispose of solid waste to avoid chocking of drain around the flyover and at grade road alignment.	• Maintenance and cleaning record • Audits and check regularly	Proponent	
6	**Road Maintenance Works and Heavy Traffic** During the operational phase, different maintenance works will be carried out throughout the Project life. Laborers or the staff involved in these maintenance works are exposed to health and safety issues.	• Implementation of HSE Plans during the maintenance period; • Strict implementation of personal protective equipment's PPEs; • Understanding and training of staff on Operation and Maintenance Manual; • Mitigations mentioned in section 7.6.3.5 shall be adopted.	• Physical observation • Regular monitoring, audits and check reports during work.	Proponent	
7	**Fauna** There is no protected area, Game reserve, Game sanctuary or national park in the Project	• The pathways of locally available wildlife and livestock for food, shelter and other normal activities must be compensated with proper alternative routes/pathways & water	• Physical observation • Regular monitoring, audits and check reports.	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Area so no major impact on Wildlife & Livestock in the area is expected through, noise, vibration and any type of normal activity in the Project Area, thus will have no effect on productivity.	points must be provided to minimize the impact and movement of available wild and domesticated animals. This has been done through provision of cattle creeps			
8	**Flora** During Operational stage the Project will not affect Flora (Trees and agricultural crops) or release any significant pressure detrimental to flora. Low level impact is expected at operational phase on Flora due to the Operational and Maintenance activities.	• The implementation of plantation plan recommends in compensation for cutting of trees should start working during operational stage, to ensure the ecological balance and to avoid any impact on local Environment. • Large scale planting with suitable indigenous fruit and forest trees, shrubs and ornamental plants in the form of Tree Groves, and Linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation.	• Physical observation • Regular monitoring, audits and check reports.	Proponent	
9	**Changes in Land-use** Road transport network development has significant impact on land use patterns. Once access has been	• Redefining basic land use allocation standards; • Improvements in the design considerations of proposed road alignment so as to promote	• Physical observation • Regular monitoring, audits and check reports during work.	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	provided, land patterns begin to change over a period of time. The results of these changes are irreversible.	sustainable development of commercial areas; and • Land use policies such as development restrictions and zoning codes (residential or commercial) and implementation of related By-Laws.			
10	**Landscape** During the operation stage, new saplings of different plants and trees would be planted to enhance the aesthetics and compensate the loss of affected trees. The presence of adequate flora at available spaces along the proposed alignment will help in absorbing flue gases, emitting from a large number of vehicles and public transport passing through the Project Area, which shall help improve the air quality.	• This will have a positive impact of permanent nature. • The saplings planted in the Project Area against the trees affected should be properly maintained	• Monitoring of plant maintenance activities records	Proponent	
11	**Change in Aesthetic Value** Construction of the proposed road, interchanges, bridges and culverts, will change the aesthetic value of the area. Proper landscaping and	• No mitigation required	• Physical observation • Regular monitoring, and check for any negative disturbance.	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	plantation of grasses and ornamental plants along the alignment will increase the aesthetic value of the proposed Project Area and will have a positive impact.				

a) Positive Impacts

32. The Project is expected to have major positive impacts due to the construction of the proposed Project:

- Upon its completion, the travelling time from the Karachi-Hyderabad Motorway, M-9 to KPT Interchange on the main Korangi Road (Formerly known as the Hino Chowk) will be reduced to only 30 minutes. Therefore, the daily commutation between Karachi Port, Industrial Areas of Landhi and Korangi, and also between the CBD Area, Clifton and DHA (Phase 1 to 8) and the proposed DHA City & the Education City would be more convenient, uninterrupted and economical;
- The traffic conditions on the urban road network in Karachi would also improve substantially as the external traffic would shift to Malir Expressway;
- In addition to light traffic, this expressway will also serve the heavy traffic generated from the Karachi Port and the Landhi - Korangi Industrial Area and going towards Motorway (M9) for onwards journey upcountry;
- The proposed Project will help reduce traffic congestions, delays, economic losses and environmental pollution on the city road network by exclusion of the external traffic i.e., traffic having both its origins and destinations outside the city or on its periphery, from the present routes to the proposed Malir Expressway;
- Improved communication infrastructure will promote new business opportunities. In addition, such an activity will also increase the land value that will benefit the local residents of industrial areas of Landhi and Korangi, and also between the CBD Area, Clifton and DHA (Phase 1 to 8) and the proposed DHA City & the Education City;
- The proposed Project is expected to increase the land values, especially in nearby settlements. Land owners will have an opportunity to sell their land at increased prices and start new businesses;
- Property Market anticipates the potential rise in property buying and selling in these areas due to ease of transportation, safety and development opportunities that facilitates investors looking for a high return and profitable investment opportunities in residential and commercial areas;
- Due to the construction of the proposed Project, economic activity will be generated in the Project Area as the labour and semi-skilled staff will have an opportunity to work in the Project Area. This will provide them an opportunity to develop their skills and capacities;
- Raising of new trees on either side of the road shall render a positive impact on the flora of the area and will also cause a positive impact on the landscape of the area, which shall be of permanent in nature; and
- After the construction of proposed road, the landscape of the Project Area will be changed in terms of road infrastructure, construction of bridges & flyovers, interchanges, and planned plantation of trees along the road. This will have a positive impact in terms of socio-economic development of the Project Area.

G. STAKEHOLDER CONSULTATION

33. The consultations were carried out during the study with relevant government departments such as SEPA, Forest, Wildlife, Fisheries, Archaeology Departments of

Sindh, etc. NGOs and local communities. Four (04) consultative meetings were held with more than 93 participants in the Study Area. The major categories participated in these meetings were local population, community groups, landowners, and Project Affected Persons (PAPs). Keeping in view the important role of the female in the household as well as in the society, gender consultations were also conducted in two (02) settlements including Shah Faisal Colony and Sommo Goth to record views of the females and issues related to the Project implementation.

34. The purpose was to engage all the stakeholders and to record their concerns. During stakeholder's consultations, information regarding Project main features and its benefits were shared. The stakeholders' concerns on land compensation, tree cutting, wildlife, livelihood support, provisions of public infrastructure, utilities and other civic facilities were raised and addressed accordingly. A grievance redress mechanism has been proposed to facilitate the concerns and grievances of affected persons during Project implementation.

H. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

35. The EMP sets out mitigation actions, monitoring actions, responsibilities and schedules for impact mitigation and monitoring. Environmental monitoring has to be undertaken during both the construction and operational phases to ensure the effectiveness of the proposed mitigation measures. The EMP also provides its implementation mechanism during construction and operational phases.

36. The EMP is prepared taking into account environmental consequences of the proposed action. Mitigation measures are suggested in environmental mitigation and management matrix at different stages of proposed Project to mitigate the potential impacts.

37. The environmental monitoring plan has also been prepared as a part of EMP which details the monitoring mechanism of a specific receptor/item, its frequency and physical/ecological parameters to be considered. The designer has carefully considered all recommendations related to the design. Though the expected construction impacts are not severe, but implementation of proper mitigation measures would be needed. A suitable training program is proposed to train the Contractor(s) staff who will be involved during construction stage and the professional staff from the Concessionaire/PMIU involved at the operational phase of the Project. All required permits shall be obtained from the concerned departments prior to starting the related activity.

EMP Budget

38. The EMP budget for one time monitoring before start of construction would be around PKR 0.28million. Tree plantation cost will be PKR 37.67million (for the restoration of ecosystem and ensure the implementation of national legislation). Total EMP budget calculated for the proposed Project is about **PKR 108.6 Million** (comprising estimated aforementioned costs and exclusion of land acquisition and compensation cost).

I. CONCLUSION

39. The report provides conclusions based on the impacts assessed and the mitigation measures suggested. The implementation of the proposed Project will have many positive impacts for the country, province and on the population residing within the CoI. Apart from the positive impacts of the Project, the proposed MEX will also have potential adverse environmental and social impacts during the construction and operational stages. Most of these adverse impacts during construction are of a temporary nature. These potential impacts can be avoided or mitigated by adopting suitable mitigation or remedial measures as mentioned in this report.

40. In order to minimize, avoid or reduce the potential adverse impact appropriate mitigation and remedial measures have been suggested against each identified impact. Efforts are made to propose economical and sustainable mitigation and remedial measures which can be easily implemented. In order to provide compensation for crops, land, structures and trees losses, a LARP should be carried out as per local laws. In the end, EMP has been developed to provide proper framework for the implementation of the suggested mitigation measures. This includes the identification of the major stakeholders, roles and responsibilities along with the resource requirements.

41. As a conclusion of the study, the proposed MEX will not cause potentially significant adverse environmental impacts that are sensitive, diverse or unprecedented after the implementation of mitigation measures. Considering the current traffic situation in the study area and the efforts being made by the GoS, the proposed Project is a prerequisite. It is suggested that the proposed Project should be implemented as soon as possible after all necessary approvals, design provisions and the implementation of EMP.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

42. Located along the shores of the Arabian Sea, Karachi, set over 3500 square kilometers, is Pakistan's gateway and largest metropolitan city, where it serves many purposes including being the provincial Capital of Sindh, being the country's main seaport, and serves as the country's economic and financial center. Much like other port cities and commercial centers in the world, Karachi attracts people from all over the country and beyond. The lure of better economic prospects has seen Karachi experience mass migrations into the city, where in a study carried out by the Japan International Cooperation Agency (JICA) in 2012, termed the Karachi Transportation Improvement Plan, the Agency predicted the growth of the city would increase from 18.9 million in 2010 to around 31.6 million in 2030, almost doubling the population.

43. This rapid increase in population has put and will continue to put a lot of pressure on the city's infrastructure especially the Urban Transport System (UTS) which is not yet organized in a manner suited to a city of this population, where the system scarcely caters to the mobility needs of the residents of the city. With dilapidated infrastructure and lack of public services, coupled with other factors such as weak traffic management, lack of modern mass transit network, the city has seen a drastic increase in the private motor vehicles present on roads. This mass influx of vehicles has resulted in severe traffic congestions, unnecessary delays, and noise, and air pollution along the main corridors of travel in the city, all in all impeding the city from realizing its true potential in terms of economic activity and efficiency.

44. To play its part in alleviating major traffic congestion along the main arteries of the city, the Malir Expressway project has been envisaged, where the project will facilitate thousands of commuters and heavy traffic from Karachi Port, Korangi Industrial Area, Landhi Industrial Area, Steel Mills, Port Qasim and other such areas towards the Northern limits of the city and the upper parts of the country through the National and Superhighways. The project is also expected to become one of the most strategic economic corridors of the city which will provide a strategic link to the M-9 and the developments happening outside the city in the form of Bahria Town, DHA City, Education City, etc.

45. The Malir Expressway project (MEX) will be a stretch of 38.75 km, initiating right before the Jam Sadiq Bridge in Korangi (near the KPT interchange), traversing along the right bank of the Malir river, through the districts of Korangi and Malir in Karachi, where it will meet the M-9 N-5 link road and take a left turn and travel parallel to the road, ultimately meeting the N-5 around the Kathore region, where it will terminate.

46. Upon its completion, the travelling time from the Karachi-Hyderabad Motorway (M-9) to KPT Interchange on the main Korangi Road (Formerly known as the Hino Chowk) will be reduced to only 30 minutes. Therefore, the daily commute between Karachi Port, Industrial areas of Landhi and Korangi, between the Central Business District (CBD) area,

Clifton and DHA (Phase 1 to 8), to the proposed DHA City & the Education City would be more convenient, uninterrupted, and economical. The traffic conditions on the urban road network in Karachi would also improve substantially as the heavy, external traffic would shift to the Malir Expressway, reducing overall congestion.

47. The Malir Expressway (Private) Limited, has been given the responsibility of developing and executing the Malir Expressway Project where after finalizing design, Right of Way (RoW) and various other technical parameters, the company now requires the approval of the Sindh Environmental Protection Agency before any construction activities may be commenced. For this, the company has engaged National Engineering Services Pakistan (NESPAK) and EMC Pakistan (Private) Limited to study the project in detail and carry out the Environmental Impact Assessment to ascertain impacts that may arise during the different stages of activity (pre-construction, construction, and operation) and advise appropriate mitigation measures, which on implementation will ameliorate the effects from these impacts.

1.2 NEED FOR AN EIA

48. The Proposed Project is in the province of Sindh, therefore the Sindh Environmental Protection Act - 2014 is the core environmental law for the proposed road Project. Under Section 17 of the Act, it is mandatory for the proponents of the projects[1] to execute either an Initial Environmental Examination (IEE) and/ or EIA, where warranted, and get the approval from SEPA. Hence for the proposed MEX Project, the SEPA is the concerned authority with respect to environmental approvals.

49. The SEPA (Environmental Assessment) Regulations, 2021 provides screening categories for the different type of environmental assessment that needs to be carried out for different projects, i.e., a Checklist, IEE, or EIA. The proposed MEX falls under the requirement for an EIA, namely: **Schedule (III) – Projects Requiring an EIA**: Category (E) – Transport: *Subcategory (2) – Construction of highway, motorways, major roads (Intercity roads) more than one km and above*. This defines the specific category of projects which this proposed project falls into and hence, requires an in-depth Environmental Impact Assessment to be carried out and submitted to the Sindh Environmental Protection Agency for their scrutiny and approval process.

1.3 OBJECTIVE OF EIA

50. The prime objective of the EIA study is to fully meet the statutory requirements set forth by the Sindh Environmental Protection Act – 2014, to facilitate decision making by the Agency regarding the environmental feasibility of the project, and subsequently comply with all their standards leading to an issuance of approval.

[1] *No proponent of a Project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof.*

51. The overall objective of this EIA is to highlight the anticipated aspects of the proposed intervention and to propose necessary mitigation measures to prevent/minimize adverse impacts on the surrounding environment and community. To achieve this objective, an assessment of the existing environmental conditions of the project corridor is a prerequisite and therefore, included after collecting the baseline data of major environmental attributes of the corridor (acquired from primary and secondary sources). This EIA has been prepared to ensure adequate environmental and social management during pre-construction, construction, and implementation stages of the proposed Project, where it provides mechanisms to ensure that potentially significant environmental and social impacts of the proposed Project are identified, assessed, and mitigated as appropriate.

52. Further specific objectives of this EIA report are to:

- Facilitate proponent of the Project in ensuring the overall environmental and social sustainability of the Project;
- Establish a baseline of existing social and environmental conditions prior to Project initiation by collecting secondary and primary data/information on the physical, biological and socio-economic environment of the Project Corridor;
- Identify potentially significant environmental and social impacts (both positive and negative) during all stages of the Project;
- Avoid, minimize, and suggest mitigation and compensation measures for significant adverse impacts;
- Conduct, record, report, and ensure public consultation, participation with major stakeholders; and
- Develop an Environmental Management Plan (EMP) for all stages of the Project as a tool for the implementation of the suggested measures along with a monitoring and evaluation mechanism.

1.4 NATURE, SIZE, MAGNITUDE AND LOCATION OF THE PROJECT

53. The proposed Project is essentially a linear road Project with some non-linear components such as interchanges. The proposed Malir Expressway will be a six (6) lane dualized highway (having a total length of 38.75km, and width of roughly 30 m) designed for high-speed traffic starting before Jam Sadiq River Bridge on Korangi Road ending near Kathore at the junction of existing Link Road and M-9 highway. The proposed Project includes six (6) interchanges for the controlled access to other link roads. The proposed Project will pass through Malir and Korangi Districts of Karachi City of Sindh province. The map showing the location of the proposed road is shown in **Figure 1.1**.

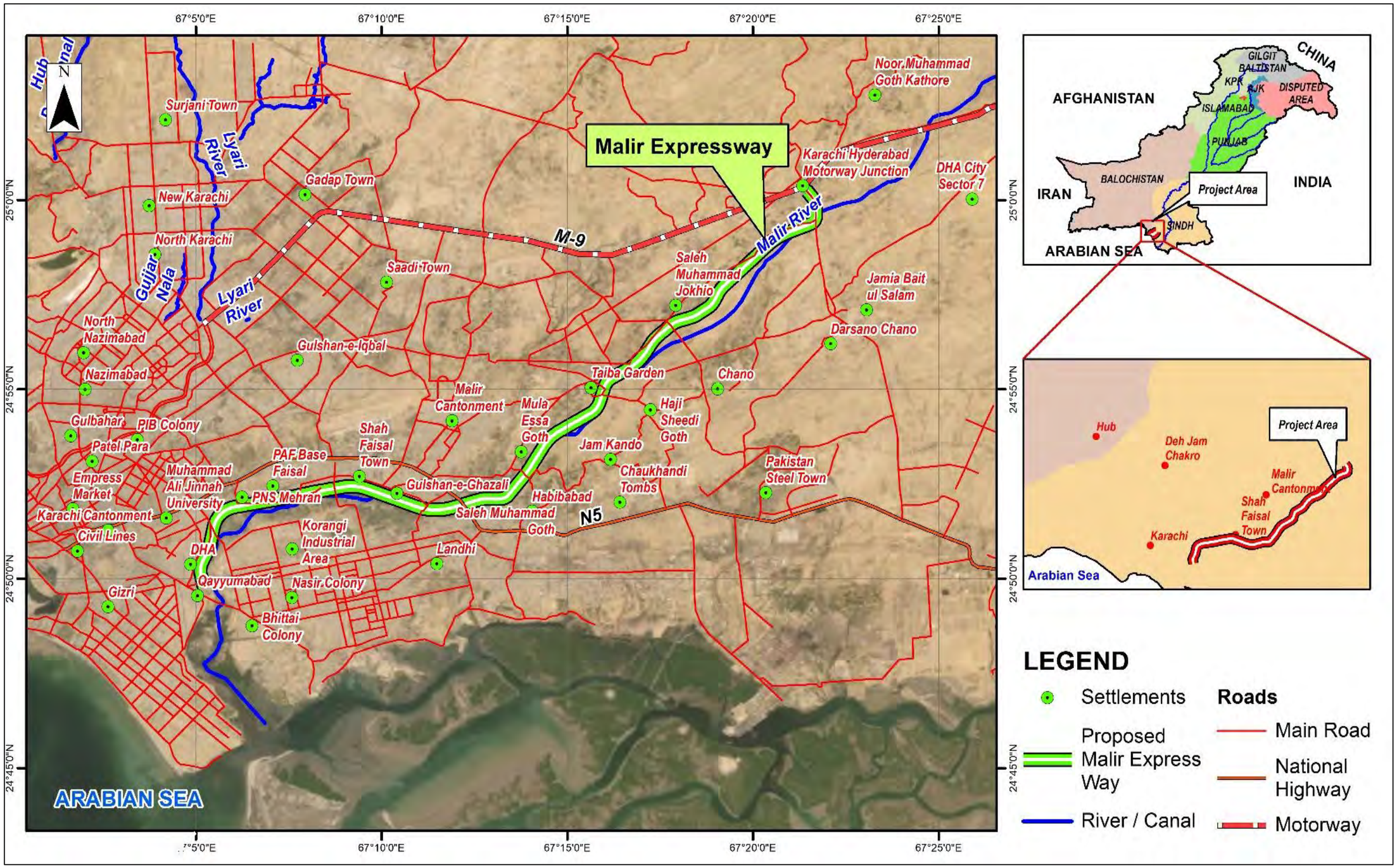


Figure 1.1: Location Map of Proposed MEX Project

1.5 PROJECT PROPONENT

54. The Company Malir Expressway (Private) Limited is the concessionaire tasked with the construction and development of the project. Further details on the project proponent are given below:

Malir Expressway (Private) Limited
A-22, KDA Scheme # 1,
Main Karsaz Road
Karachi, Pakistan
Telephone: 021-34920991-92

1.6 CONSULTANT EIA TEAM

55. The EIA teams from both consulting firms, NESPAK and EMC, have been engaged in the preparation of this EIA report for the proposed Project. The details of consultant are provided below:

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LIMITED (NESPAK)
NESPAK House: 1-C, Block-N, Model Town Extension, Lahore, 54700, (P.O. Box 1351), Pakistan
Telephone Number: 92-42-99090000
Fax Number: 92-42-99231950
Company E-mail Address: info@nespak.com.pk
Company Website: www.nespak.com.pk

EMC PAKISTAN (PRIVATE) LIMITED
Office 503,5th floor, Anum Estate Building,
Main Shahrah-e-Faisal, opp. Duty Free Shop,
Karachi, Pakistan.
Telephone Number: 92-21-34311466
Fax Number:
Company Email Address: mail@emc.com.pk
Company Website: www.emc.com.pk

56. The EIA teams comprising of environmental engineers/scientists, sociologists and ecologists have been involved in the preparation of this EIA report for the proposed Project. The professional staff involved, worked on data collection, analysis of data, impact assessment, mitigation measures and report compilation. The social aspects of the EIA were taken up by the social safeguard's specialist of the Project and the relevant inputs were prepared by social team. These inputs were received and incorporated in the EIA report. In addition, the EIA team worked in close coordination with the design team and several inputs were provided by the design specialists to the EIA team. The detail of the EIA team is given in **Table 1.1** below:

Table 1.1: Team Composition for the EIA Study

Sr. No.	Name of Expert	Designation
NESPAK		
1.	Mr. Irfan-ul-Haq	Vice President/Head GT&GE
2.	Mr. Muhammad Shariq Ahmed	Chief Engineer/Head ERSD
3.	Mr. Hammad Qamar	Principal Engineer
4.	Mr. Fahad Saleem	Senior Environmental Engineer/Modeling Expert
5.	Mr. Shoaib Aziz	Senior Engineer
6.	Ms Sanobar	Senior Environmentalist / Gender Expert
7.	Mr. Muhammad Sajjad	Senior Sociologist
8.	Mr. Makhdum Ali Sheikh (late)	Ecological Expert
9.	Mr. Noor Elahi	Aquatic Expert
10.	Mr. Ibadullah	Senior Ecologist/Biodiversity Expert
11.	Ms Ridha Kamran	Technical Coordinator
12.	Mr. Muhammad Muneeb Yousaf	GIS Expert
EMC Pakistan		
13.	Mr. Syed Nadeem Arif	Managing Director
14.	Mr. Muhammad Haseeb	Senior Environmentalist
15.	Mr. Ahmed Zohair Siddiqui	Senior Environmental Engineer
16.	Mr. Syed Omar Arif	Environmental Engineer
17.	Mr. Khurram Shams	Senior Social Safeguards Expert
18.	Mr. Wajai Kumar	Community Mobilization Expert
19.	Mr. Sohaib Tariq	Sustainability Engineer
20.	Mr. Muhammad Rizwan	Occupational Health & Safety Expert

1.7 NEED FOR PROJECT

57. This project, when established, will:

- Establish a direct southern transport link between the Karachi Port (including the allied facilities of SAPT, PICT, KICT and the Keamari Oil Terminal) to the Karachi – Hyderabad Motorway (M-9);
- Facilitate the movement of goods between Karachi Port and its allied facilities, Industrial Areas of Landhi and Korangi and the up-country locations;
- Provide a safer and faster link between the planned developments of the Education City, DHA City and Bahria Town along the Motorway M-9 in the Northern suburbs of the city to the main business center (CBD area) near the Karachi Port and also to the southern DHA and Clifton Areas;
- Link Malir Cantonment directly to the Karachi – Hyderabad Motorway (M-9) through a faster route for swift and easier movement of military troops in case of any emergency; and
- Help reduce traffic congestion, delays, economic losses, and environmental pollution on the city road network by exclusion of the external traffic i.e., traffic having both its origins and destinations outside the city or along its periphery, from the present routes to the proposed Malir Expressway.

1.8 APPROACH AND METHODOLOGY

58. The detailed approach and methodology used for the EIA study is provided below.

1.8.1 Literature Review

59. Prior to mobilization, the consultants conducted a desk study, which comprised of collection and review of guidelines, data and reports related to the Project, that included (a) review of National Environmental Legislations; (b) Google Earth Satellite Imagery; (c) Relevant District Census Reports (DCR) and any other relevant documents/drawings; (d) Consultancy / Transaction Advisory Services for Development of Malir Expressway (From Motorway, M9 to KPT Interchange) - Final Report, October 2019; Census Survey by Pakistan Bureau of Statistics, 1998 and 2017 for socio-economic data; and other design data provided by the Client and Project Design Consultant; and (d) Reference similar Project EIA documents.

1.8.2 Review of Environmental Laws and Institutional Requirements

60. The Project needs to comply with all the applicable environmental policies, laws, guidelines, acts and legislations of the government of Pakistan,

1.8.3 Delineation of Corridor of Impact (CoI) and Right of Way (RoW)

61. As per the national, impacts and risks have been analyzed within the Project CoI. The CoI of the Project encompasses primary Project site(s) and related facilities that the contractor develops or controls, such as MEX route, access roads, borrow pits, disposal areas and construction camps. Environmental impacts and risks were analyzed for all relevant stages of the Project cycle, including pre-construction, construction, and operation phases of the Project.

62. The CoI includes the actual RoW of Project as well as the surrounding areas where positive and adverse impacts may be foreseen due to the implementation of the proposed Project. RoW of the proposed MEX Project from the center line is 50 m on each side of the centerline, however the actual width of the road on each side of the centerline is roughly 27 km (road width 15 m + embankment width 12 m). Due to this, the CoI of the project is taken similar to the RoW of the project, at 50 m on each side, for a total of 100 m.

1.8.4 Analysis of Alternatives

63. It is a mandatory requirement for any EIA study to analyze each potential alternative available that could have been developed to meet the objectives, and accordingly recommend the most environmentally and economically feasible option.

64. To select the most viable route keeping in view the environmental, economic, and social constraints, the analysis of different alternatives was carried out for the selection of the most feasible MEX route for the study in consultation with the Client. Moreover, the No Project Option (NPO) was also considered with reference to the increased traffic volume

and time delays with the to existing infrastructure. This exercise confirmed the justification for the need of the proposed Project.

1.8.5 Environmental Baseline Survey of the Project

65. After the selection of the most feasible route for the MEX based on satellite images and the delineation of CoI, detailed environmental surveys were carried out within the CoI for environmental parameters on which any adverse or positive impacts were envisaged by the implementation of the proposed Project. Prior to the start of field survey activities, comprehensive checklists, proformas and maps were developed covering the following main parameters:

a) Physical Environment

66. The information acquired for the establishment of physical environment baseline included the following main parameters:

- Land resources (including land use pattern, soil composition, contamination of soil and soil erosion etc.);
- Water resources (including available surface and groundwater resources and natural streams, hydrology, spring water, water supply, water contamination etc.);
- Climate data (including temperature, rainfall, humidity, wind speed and direction etc);
- Ambient air quality and noise level monitoring data;
- Existing solid waste management and effluents disposal practices and storm water drainage;
- Buildings and infrastructure details, including residential, commercial, and animal shed for complete/partial relocation; and
- Other private/public infrastructures such as roads, telephone poles, hand pumps, tube wells, schools, universities, markets, hospitals, shops, libraries, mosques, etc.

b) Environmental Monitoring, Sampling, Testing and Modelling

67. Environmental Monitoring has the key role to assess the status of the existing environment that changes spatially and temporally. However, the goals, sample collection strategies, and methods of analysis used in monitoring must be well defined in advance to obtain robust results. In the preparation of a sampling plan, goals, strategies, and methods must be considered in conjunction with an understanding of the target environment, including the physical, chemical, and biological variables and processes involved. Environmental monitoring was conducted for the following parameters:

- Ambient Air Quality Monitoring (8 - 24 hours);
- Above Ground Noise Measurement (24 Hours);
- Vibration Measurement (24 Hours); and
- Sampling & Analysis of Surface Water, Ground Water and Wastewater (if available)

68. Air dispersion modelling (line source) for proposed Project were conducted by using internationally acceptable air modelling software such as CALROADS.

c) Ecological Environment

69. The Integrated Biodiversity Assessment Tool (IBAT) was utilized to carry out the initial ecological screening of the area. The information/data of IBAT was further refined and verified by utilization of various tools including literature review, stakeholders/departmental consultations, and random ground trothing at site. The field data of the following ecological components was also collected:

- Flora (trees, herbs, shrubs, grasses and overall vegetation including valuable or rare trees and their loss due to implementation of the Project etc.);
- Fauna/ Wildlife (Mammals, reptiles, amphibians and avifauna.);
- Agriculture and livestock;
- Protected areas, National Parks, Game reserves, Game sanctuaries any other ecologically important areas. (if any);
- Migratory birds' corridors; and
- Endangered species (both flora and fauna).

d) Socio-Economic Environment

70. A sample survey was carried out within the CoI to develop the socio-economic baseline information of the general settled population. Based on the sampling methodology, in total 240 households were interviewed within these villages/settlements located along the CoI and consulted for the collection of baseline socio-economic data.

71. The following major aspects were covered in the socio-economic baseline survey of the sample population settled along the CoI:

- Demographic characteristics;
- Literacy status/ education;
- Nature of business/occupation;
- Livelihood/income;
- Living standard of the population;
- Access to credit;
- Social Infrastructure available;
- Gender issues;
- Pressing needs of the people;
- Community perception about the Project etc.;
- Labor Influx to Project Area;
- Waste management services;
- Religious, cultural and heritage information (mosques, shrines, graveyards);
- Archaeological monuments; and
- Other aspects.

1.8.6 Stakeholder Consultations

72. The Consultants identified Project stakeholders during the inception/scoping stage and held meetings with them during the surveys to receive feedback on the expected environmental and social issues related to the Project impacts. Meetings/e-communication were carried out with the Project affected, relevant departments including

Forest, Wildlife, Archeology, Agriculture, Social Welfare, SEPA, Works and Services Department, Non-Governmental Organizations (NGOs) etc. to discuss the issues/constraints and to obtain their views and feedback to mitigate the potential environmental impacts associated with the construction and operation of the Project.

73. Based on the above, letters were also written to the concerned Forest, Wildlife, Archaeology, and other departments through Client for e-communication. The proceedings of the consultations/meetings/e-communications along with the photographs and list of participants are documented in Chapter 6.

1.8.7 Impact Assessment and Mitigation Measure

74. A logical and systematic approach was adopted for impact identification and assessment. The impact assessment process began during the screening phase and continued through scoping which identified the key issues and classified them into different categories. The tools, which were used for impact assessment, are:

- Checklists;
- Matrices; and
- Overlays.

75. Identification of potential environmental and social impacts in terms of their nature, magnitude, extent, location, timing, and duration were carried out. The impacts were correlated to the Project location, design stage, construction as well as operation stage. Based on the impact prediction methods and because of public/stakeholder consultations, the consultants screened the adverse environmental impacts for inclusion in the mitigation measures and environmental management plan. The same process was followed for the identification of social impacts. Public consultations (which provided feedback of the impacts from the stakeholder's viewpoint) were used to screen out the insignificant impacts. Matrices and overlays were used for the evaluation of temporal and spatial impacts respectively.

76. The Consultants proposed practicable, economically feasible and socially acceptable mitigation measures for the significant adverse environmental and social impacts. These measures were based on exploring ways to achieve the Project objectives while causing the least amount of disturbance possible to the existing environment by alternative ways, through improved monitoring and management practices (storage of construction materials, labor camps, waste disposal, disposal of construction debris etc. or through monitory compensation).

1.8.8 Grievance Redressal Mechanism

77. A Grievance Redressal Mechanism (GRM) is important for developmental Projects where ongoing risks or adverse impacts are anticipated. This mechanism serves to meet requirements, prevent, and address community concerns, reduce risks, and assist larger processes that create positive social change. The GRM for the proposed Project along with the committee composition has been suggested along with the procedures for

handling environmental and social concerns of the Project stakeholders. This procedure includes a redress mechanism scaled to the Project's identified risks and adverse impacts, focusing on stakeholders.

1.8.9 Environmental Management Plan (EMP)

78. An EMP has been prepared to ensure the adequacy and effectiveness of the proposed project by clearly identifying the roles and responsibilities of the agencies responsible for implementation, monitoring and auditing of EMP activities required, existing and suggested framework, necessary approvals, and training needs. The EMP also includes organizational setup, a monitoring mechanism, monitoring plan, environmental and social parameters to be monitored with their frequency. Similarly, costs for environmental monitoring, ecological and social component/social mitigation measures were also included as part of the EMP. Environmental monitoring, evaluation, auditing and reporting mechanism were also proposed in the EMP.

1.8.10 Conclusions and Recommendations

79. Based on the baseline conditions, identified impacts, and suggested mitigation measures and proposed environmental cost, conclusions have been developed along with recommendations regarding the future of action and outcome of the EIA report.

1.9 ORGANIZATION OF REPORT

80. This report contains ten chapters. The contents of chapters are described as under:

- **Chapter 1**– "Introduction" describes introduction, location of Project, objective and purpose of the EIA report;
- **Chapter 2** – "Environment Legislative Requirements and Framework" elucidates the current legal framework including national and funding agency's guidelines which is applicable to the proposed Project in the context of environment and sustainable development;
- **Chapter 3** – "Project Description" furnishes an overall description of the Project, including its background, features and key components, timeframe and cost;
- **Chapter 4** – "Project Alternatives" provides details on alternate routes and options considered for the proposed interventions, location and design;
- **Chapter 5** – "Description of the Environment" comprises a detailed narrative of the existing (baseline) conditions of the Project Area, with respect to its physical, biological and socio-economic environment;
- **Chapter 6** – "Information Disclosure, Consultation and Participation" provides summary of consultative sessions with the local community as well as with other stakeholders including local politicians, local government officials, policy makers and NGOs for their opinions and suggestions on the Project;
- **Chapter 7** – "Anticipated Environmental Impacts & Mitigation Measures" elaborates the likely impacts of the Project on the physical, biological and socio-economic environment during the construction and operation stages and lays down the proposed measures to mitigate the adverse impacts of the Project;
- **Chapter 8** – "Grievance Redress Mechanism" describes the need for establishing a grievance redress mechanism and define the grievance redress procedure;

- **Chapter 9** – "Environmental Management Plan" provides the mechanism to be adopted for the implementation of measures and monitoring the environment during all stages; and
- **Chapter 10** – "Conclusion and Recommendations" gives the conclusion of the impact assessment study and recommendations for the construction and operational stage.

2 ENVIRONMENT LEGISLATIVE REQUIREMENTS AND FRAMEWORK

2.1 GENERAL

81. This chapter provides an overview of the policy framework and legislation that applies to the project and its operations. The Project needs to comply with all the applicable environmental policies, laws, guidelines, acts and legislations of Government of Pakistan along with the provincial government.

2.2 SUMMARY OF RELEVANT STRATEGIES, POLICIES, ACTS AND LEGISLATION

82. The summary of major relevant strategies, policies, acts and legislation from environmental perspective are briefly described in **Tables 2.1 & 2.2** below:

Table 2.1: Main Strategies/Policies Related to Environment and Relevance to the Project

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
1.	National Conservation Strategy, 1992	Pakistan National Conservation Strategy (NCS), which was approved by the Federal Cabinet in March 1992, is the principal policy document on environmental issues in the Country. The NCS outlines the Country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment.	The core areas that are relevant in the context of the proposed Project are pollution prevention during construction and conserving biodiversity and forestry.
2.	National Environmental Policy, 2005	In March 2005, Government of Pakistan (GoP) launched its National Environmental Policy, which provides a framework for addressing the environmental issues. Section 5 of the policy commits for integration of environment into development planning as instrument for achieving the objectives of National Environmental Policy. It also provides broad guidelines to the Federal Government, Provincial Governments, Federally Administered Territories and Local Governments to address their environmental concerns and to ensure effective management of their environmental resources.	Clause (b) of sub-section 5.1 states that EIA related provisions in Environmental Protection Act, 1997, will be diligently enforced for all developmental projects.
3.	Pakistan Labor Policy, 2010	The main objective of the Labor Policy, 2010 is the social and economic well-being of the labor of Pakistan. The Labor Policy, 2010 has following 4 parts: Legal Framework; Advocacy: rights of workers and employers; Skill development and employment; and Manpower export.	Labor will be employed for construction of the proposed Project. The provision of policy will apply to all the labor employed.
4.	Pakistan Climate Change Act, 2017	Pakistan is a party to UNFCCC, 1992 and Kyoto Protocol to the UNFCCC, 1997. It also initiated the process for ratifying the Paris Agreement, 2015 which recognizes that Climate Change represents an urgent and potentially irreversible threat to human societies and the planet and thus is a global challenge. The Act calls for establishment of	Relevant as the project activities will result in anthropogenic emissions of gaseous compounds.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
		independent Pakistan Climate Change Authority under the guidance of high-powered Pakistan Climate Change Council to provide a framework for mitigating and adapting to the effects of the changing climate on various sectors of the economy and developing response strategies to climate change. The Act also establishes Pakistan Climate Change Fund. Money from Fund will also be utilized for financial assistance to suitable adaptation and mitigation projects.	
5.	National Water Policy 2018	This first ever water policy was unanimously approved in April 2018 by Council of Common Interest (CCI). The Policy aims at efficient management and conservation of existing water resources, optimal development of potential water resources, steps to minimize time and cost overruns in completion of water sector projects, equitable water distribution in various areas and canal commands, measures to reverse rapidly declining groundwater levels in low-recharge areas, increased groundwater exploitation in high-recharge areas, effective drainage interventions to maximize crop production, improved flood control and protective measures, steps to ensure acceptable and safe quality of water, minimization of salt build-up and other environmental hazards in irrigated areas, institutional reforms to make the managing organizations more dynamic and responsive. The policy covered all water related issues, including water uses, allocation of priorities, integrated planning for development, use of water resources, environmental integrity of the basin, impact of climate change, trans boundary water sharing, irrigated and rain fed agriculture, drinking water and sanitation, hydropower and industry, groundwater, water rights & sustainable water infrastructure, water related hazards, quality management, awareness, conservation, legal and capacity building of infrastructure.	The proposed Project is located at the bank of the major non-perennial water resource (Malir River) through which water is being utilized for local level irrigation, livestock, etc. purposes.
6.	National Sustainable	The National Sustainable Development Strategy is an attempt to define sustainable development and the pathway to a “green economy” in Pakistan’s context. It lays out an adaptive system and approach that can be continuously	This strategy is applicable as the Project involves the construction of expressway for improving the traffic

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
	Development Strategy, 2012	improved, through regular updates, to respond to evolving challenges. The focus has been on integrating not only across the three overall dimensions of economic, social and environment but also integrating the goals with the existing development paradigm with the aim of shifting it on to a more sustainable pathway.	situation with least environmental burden and for sustainable operation of transport in the city.
7.	Sindh Strategy for Sustainable Development, 2007	The Sindh Strategy for Sustainable Development (SSSD) proposed a ten-year sustainable development agenda for Sindh. The main focus of SSSD is to promote the sustainable use of natural resources. It targets to reduce poverty and enhance social development through the participation of the people of Sindh. The SSSD recommends that the rehabilitation and extension of water supply and sanitation networks, effective water and wastewater quality monitoring and treatment to comply with SEQS, improved coordination among stakeholders (public agencies, private sector, and residents) for the effective management of air pollution, consultation based infrastructure planning and development with main focus on minimizing traffic and pollution hazards, and conducting environmental impact assessment of all the major projects. SSSD recommends for the sustainable development and environmentally complying operations of industries: incentive mechanisms for reducing pollution; awareness raising of industrialists and stakeholders; promote cleaner production; enforce pollution charges as per SEPA 2014; prepare baseline of all industrial estates and sites to establish the pollution levels, waste disposal practices, air emissions, generation of hazardous waste for the preparation of environmental management plans for complying SEPA 2014; preparation of EIAs for all industrial development and infrastructure projects.	This strategy is applicable as the Project involves the construction of expressway for improve the traffic situation with least environmental burden and sustainable operation of transportation in the city.
8.	Sindh Drinking Water Policy, 2017	This policy is to provide safely managed drinking water whose supply is adequate, well maintained and sustainable; and to enhance public awareness about health, nutrition and hygiene related to safe drinking water. The basic objective of this policy is to introduce legislative measures and regulations to	This policy is applicable for the Project construction phase in terms of regular water quality monitoring, all discharges comply with environmental quality standards and reuse, recycle and

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
		create an enabling framework for safely managed drinking water supply, regulation of water usage, extraction, treatment transportation and distribution.	recharge of wastewater for other municipal and productive use.
9.	National Action Plan for COVID-19 Pakistan	Government of Pakistan has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at https://www.nih.org.pk/wp-content/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf. The Government of Pakistan has launched the real-time data portal for COVID-19 http://covid.gov.pk/. These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at https://www.nih.org.pk/wp-content/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf.	This Action Plan for COVID-19 is applicable to the proposed Project as it is being launched during this pandemic.

Table 2.2: Legislation/Acts Related to Environment and Their Relevance to the Project

Sr. No.	Sr. No.	Act	Brief Coverage
1.	Sindh Environmental Protection Act, 2014	Sindh Environmental Protection Agency as a part of Sindh Act No. VIII of 2014 prepared Sindh Environmental Protection Act (SEPA), 2014 which was passed by the provincial assembly of Sindh on 24th February, 2014 and asserted by the Governor of Sindh on 19th March, 2014 and notified on 20th March, 2014. It is a fairly comprehensive legislation and provides legislative framework for protection, conservation, rehabilitation and improvement of the environment. It contains concrete action plans and programs for the prevention of pollution and promotes sustainable development. Act has 11 parts with 37 Sections followed by sub-sections and clauses. Part VI is related to the environmental examinations and assessments while part X is related to the public participation.	This Act has a direct bearing on the proposed Project as the Project requires an Environmental Impact Assessment (EIA). Furthermore, the proposed Project is located mainly in Malir and Korangi Districts, Karachi and so it falls under the jurisdiction of the SEPA that will be the responsible authority for approval of the EIA of the proposed Project falling in Sindh province.
2.	Sindh Environmental Protection Agency, (Environmental	The Regulation classifies projects based on the expected degree of adverse environmental impacts and lists them in three separate schedules. Schedule I lists projects that may not have significant environmental impacts and therefore require an Environmental Checklist. Schedule II lists projects of considerable environmental impacts requiring preparation of an IEE report. Schedule III lists projects of potentially adverse environmental impacts requiring preparation of	The provisions of these regulations are applicable for environmental screening of the Project, which implies that an EIA is required for the proposed Project.

Sr. No.	Sr. No.	Act	Brief Coverage
	Assessment) Regulations, 2021	an EIA report. The regulation also requires that all projects located in environmentally sensitive areas require preparation of an EIA.	
3.	Sindh Environmental Quality Standards (2016)	SEPA has formulated the Sindh Environmental Quality Standards (SEQS) as per Clause (g) of sub-section (1) of Section 6 of SEPA Act 2014. The SEQS were promulgated in 2016 which includes standards for liquid effluent, industrial gaseous emissions, ambient air, drinking water quality, noise levels and standards for motor vehicle exhaust, diesel vehicle, and petrol vehicles.	All projects to be implemented in Sindh must conform to SEQS during all the phases i.e., construction and operation.
4.	Guidelines for the Preparation and Review of Environmental Reports, 1997	These guidelines describe the format and content of IEE/EIA reports to be submitted to SEPA for obtaining NOC/approval. The guidelines present: • The environmental assessment report format; • Assessing impacts; • Mitigation and impact management and preparing an environmental management plan; • Reporting; • Review and decision making; • Monitoring and auditing; and • Project Management.	The guidelines are applicable for the preparation of the EIA.
5.	Guidelines for Environmental Assessment	Pakistan EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development Projects. The guidelines that are relevant to the proposed Project are listed below. • Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997; • Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May, 1997; and • Sectoral Guidelines: Pakistan Environmental Assessment Procedures, Pakistan Environmental Protection Agency, October 1997.	The guidelines are applicable for the preparation of the EIA.

Sr. No.	Sr. No.	Act	Brief Coverage
6.	Sindh Forest Act, 2012	The Forest Act 1927 has been replaced by the provincial Forest Act 2012, after forestry became into the provincial domain under the 18th amendment to the Constitution of Pakistan. However, the main applicable clauses still hold true in essence. The Act reserve the areas having forest cover, or significant wildlife, to regulate movement and transit of forest produce, and duty leviable on timber and other forest produce. It also defines the procedure to be followed for declaring an area to be a Reserved Forest, a Protected Forest or a Village Forest.	This Act will be relevant in case if any part of the proposed intervention is located on a land previously prescribed as Forest Land by the Government. In such cases, land acquisition will be governed under this Act, and the provincial department responsible for the Project, will need to negotiate with the provincial Forest department.
7.	Sindh Wildlife Protection, Preservation, Conservation and Management Act, 2020	The Sindh Wildlife Protection, Preservation, Conservation and Management Act, 2020 aims to enhance protection for wildlife. Its passing marked the repealing of a weaker law, hardly providing any protection to wild animals, for the first time since 1972. The new legislation has wider coverage, protecting even those wild animals that enter Sindh via trans-boundary migration or because of human activity.	As the proposed Project does not passes through any wildlife protected area in its vicinity nor does it fall under the flyway zone of migratory birds, no provision of this law would be applicable to it.
8.	Sindh Cultural Heritage (Preservation) Act, 1994	This provincial act empowers the Government of Sindh to preserve and protect any premises or objects of archaeological, architectural, historical, cultural, or national interest in Sindh by declaring them protected.	None of the sites protected under this law has been identified within the RoW/CoI of the proposed Project.
9.	Sindh Solid Waste Management Board (SSWMB) Act, 2014	The SSWMB Act, 2014 enacted to establish a board for collection and disposal of all solid waste, to arrange effective delivery of sanitation services, to provide pollution free environment and to deal with other relevant matters. The Board established under the Act headed by the Chief Minister or his nominee and constitutes of thirteen other ex-officio members of other relevant departments.	This act is applicable as Project will generate the solid waste which will be managed and disposed of as per the legislative requirements of this act.
10.	The Sindh Local Government Act 2013 and Sindh Local Government	Under the Sindh Local Government Act 2013 (SLGA), Chapter VI, land use planning; implementation of building by-laws; management of environmental and health hazards; food adulteration; provision and maintenance of water supply schemes and public sources of drinking water; and mobilization of	This act is applicable for the proposed Project due to its location and nature of use of public sources during

Sr. No.	Sr. No.	Act	Brief Coverage
	(Amendment) Act, 2019	communities for the upgrade of local infrastructure (transportation, landscaping, and removal of encroachments) are the responsibilities of municipal corporations/committees.	construction stage of the proposed Project.
11.	Sindh Public Property Act, 2010	The act has been passed to avoid illegal encroachments and provide measures for removal of encroachment from public property and to retrieve possession. The City Government will provide continuous oversight and reinforcement to facilitate the properties to remain free from illegal encroachments.	This act is applicable if there is any encroachment at the proposed public/ government land.
12.	The Sindh Occupational Safety and Health Act, (2017)	The act makes provisions for occupational safety and health conditions at all workplaces in the province for the protection of workers during work. Under the Act, an Occupational Safety and Health Council will be established in Sindh with secretary of Sindh government's Labor and Human Resources Department as its chairperson. The proposed council lays down penalties in case of death and injury due to violation. In case of death sub-section 01 of section 38 will accord 2 years' imprisonment or a fine of PKR 100,000 or both. Similarly, in case of injury the imprisonment may extend to six months or a fine up to PKR 20,000 or both.	The act applies in any Project situation where worker's rights and protections are enforced. This law is applicable to construction and Project workers and will be complied during construction and operation phases.
13.	The Sindh Transparency and Right to Information Act, 2016	The purpose of this Act to provide transparency and freedom of information to ensure that all citizens have better access to public information, to make the government more accountable to citizens, to enforce the fundamental right to information in all matters of public importance, toensure transparency in all Government matters. Transparency and access to information are essential principles of democracy which not only enable the citizens to hold the Government and their institutions accountable but also help in improving the system ofgovernance.	This act is applicable as the proposed Project is the public sector Project and shall be transparent for public.
15.	Explosives Act, 1884	It provides regulations for handling, transportation and use of explosives.	Under the Explosives Act, the Project contractors are bound by regulations on handling, transportation and using explosives during quarrying, blasting and other purposes. In case of

Sr. No.	Sr. No.	Act	Brief Coverage
			controlled blasting involve for the proposed Project, this act will be applicable in Sindh.
16.	Pakistan Antiquities Act, 1975	The Antiquities Act, 1975 (amended in 1990) states the following: • "Ancient" is any object that is at least 75 years old; • All accidental discoveries of artefacts must be reported to the Federal Department of Archaeology; • The Government is the owner of all buried antiquities discovered on any site, whether protected or otherwise; • All new construction within a distance of 200 feet from protected antiquities is forbidden; • No changes or repairs can be made to a protected monument, even if it is owned privately, without approval of the responsible authorities; and • The cultural heritage laws of Pakistan are uniformly applicable to all categories of sites regardless of their state of preservation and classification as monuments of national or world heritage.	Although no antiquity site has been identified within the proposed CoI. However, the law will be applicable to the Project mainly due to its two provisions: ▪ According to the law, any construction activity within 61 m or 200 ft. of protected antiquities, are prohibited. ▪ The provisions of this act would also be applicable, if any accidental archaeological discoveries may occur during the excavation works for the construction of proposed Project.
17.	Pakistan Penal Code, 1860	The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents.	The provisions of the Penal Code, 1860 are applicable to the Project in terms of penalties for effecting human lives and public property. It also addresses the control of noise, air emissions and effluent disposal.
18.	The Protection against Harassment of Women at the Workplace Act, 2010	The Protection Against Harassment of Women at the Workplace Act (2010) refers to sexual harassment at the workplace.	This Act will be applicable to the Project if women are employed for the construction of the proposed Project.

Sr. No.	Sr. No.	Act	Brief Coverage
19.	Employment of Children Act, 1991	Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any construction, or any other hazardous employment. In accordance with this Article, the Employment of Child Act 1991 prohibits child labor (a child is under 14 years old).	The relevance of this act to the Project will be to prohibit child employment for construction of the proposed Project.
20.	Labor Laws as part of Constitution of Pakistan 1973,	The Constitution of Pakistan contains a range of provisions with regards to labor rights, in particular: • Article 11 of the Constitution prohibits all forms of slavery, forced labor and child labor; • Article 17 provides a fundamental right to exercise the freedom of association and the right to form unions; • Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and • Article 37(e) makes provision for securing just and human conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment. Labor law is controlled at both provincial and national levels with compulsory employment agreements containing the terms set out by the labor laws. The labor laws are a comprehensive set of laws in Pakistan dealing with the following aspects: • Contract of Employment; • Termination of Contract; • Working Time and Rest Time; • Working hours; • Paid Leave; • Maternity Leave and Maternity Protection; • Other Leave Entitlements; • Minimum Age and Protection of Young Workers; • Equality • Pay Issues; • Workers' Representation in the Enterprise;	The labor laws are relevant as it would deal with employment of labor for the construction of proposed Project. Following are the major labor laws which are applicable to the Project: • Bonded Labor System (Abolition) Act, 1992 • Employment of Child Act, 1991 • Minimum Wages Ordinance, 1961 • Industrial Relations Act, 2010

Sr. No.	Sr. No.	Act	Brief Coverage
		• Trade Union and Employers Association Regulation; and • Other Laws.	
21.	The Canal and Drainage Act, 1873	The Canal and Drainage Act 1873 (CDA) focuses on construction and maintenance of drainage channels and defines powers to prohibit obstruction or order their removal. It also covers issues related to canal navigation. It briefly addresses issues relating to environmental pollution. Section 70(5) of the CDA clearly states that no one is allowed to "corrupt or foul the water of any canal so as to render it less fit for the purposes for which it is ordinarily used." In addition, Section 73 of the CDA gives power to arrest without warrant or to be taken before the magistrate a person who has willfully damaged or obstructed the canal or "rendered it less useful."	This act will be applicable as the proposed Project involves the construction of expressway along the Malir River (one of the major flood water and drainage structure of Karachi city).
22.	Land Acquisition Act, 1894 and Land Acquisition (Sindh Amendment) Act 2009	The primary law for acquisition of land for public purposes in Pakistan is the "Land Acquisition Act (LAA), 1894" (hereinafter referred as the Act). The land acquired under the Act vests in the Province and it is only thereafter that the Province may transfer it to someone else. The Sindh Amendment 2009 of LAA 1894 specifically related to Section 16, Section 23, Section 24 and Section 28-A.	Though this LAA 1894 and its Sindh amendment 2009 is relevant to the Project, its covenants have been covered mainly in the LARP report which will be prepared separately.
23.	National Disaster Management Act, 2010	National Disaster Management Act, 2010 was passed by Parliament of Pakistan in 2010. The Act applies to whole Pakistan. The Act was passed in backdrop of 2010 Floods in Pakistan and strengthens Disaster Management system.	This act is applicable to the proposed Project due to its location. The proposed Project will require special consideration of flood disasters and risk management strategies as per the Act.
24.	Sindh EPA Hazardous Substances Rules, 2014	The rule describes the procedure of handling, transportation and disposal of hazardous substances and hazardous waste. General safety precautions for handling hazardous substances as well as safety precautions for workers, and notification requirements in the event of an accident are also described in these rules.	This rule is applicable to the proposed Project due to involvement of hazardous waste handling, use and disposal during different construction activities at the construction stage.
25.	Building Code of Pakistan, 2007	The provision of Building Code of Pakistan shall apply for engineering design of building like structure and related components. The construction in violation of the Building code shall be deemed as violation of professional engineering	These codes shall be used in structural design of building area components

Sr. No.	Sr. No.	Act	Brief Coverage
		work. Moreover, a certificate for the proposed action will be obtained from Provincial Building Control Authority.	constructed under this proposed Project.
26.	The Sindh Minimum Wages Act, 2015	To provide the regulation of minimum rates of wages and various allowances for different categories of workers employed in certain industrial and commercial undertakings and establishments.	This Act will be applicable to the Project to ensure that the minimum wages and allowances should be given to the Project labor (skill and unskilled employed for the construction of the proposed Project.

2.3 COMPLIANCE PROCEDURE FOR OBTAINING NOC FROM SEPA

83. Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021 provides the necessary details on the preparation, submission, and review of the IEE and the EIA reports. Categorization of projects for IEE and EIA is one of the main components of these regulations. Projects have been classified based on expected degree of adverse environmental impact.

84. The proposed Malir Expressway Project falls under Schedule III (Category 'E' of "Transport – Construction of highway, motorways, major roads/ intercity roads more than one km and above") and requires an EIA study for obtaining NOC/environmental approval from SEPA.

85. The regulations stipulate that within sixty (60) working days of EIA study submission, SEPA would make every effort to complete the EIA. The review process will be followed by public hearing and committee of experts after which SEPA will issue the decision on the EIA (refer **Figure 2.1**).

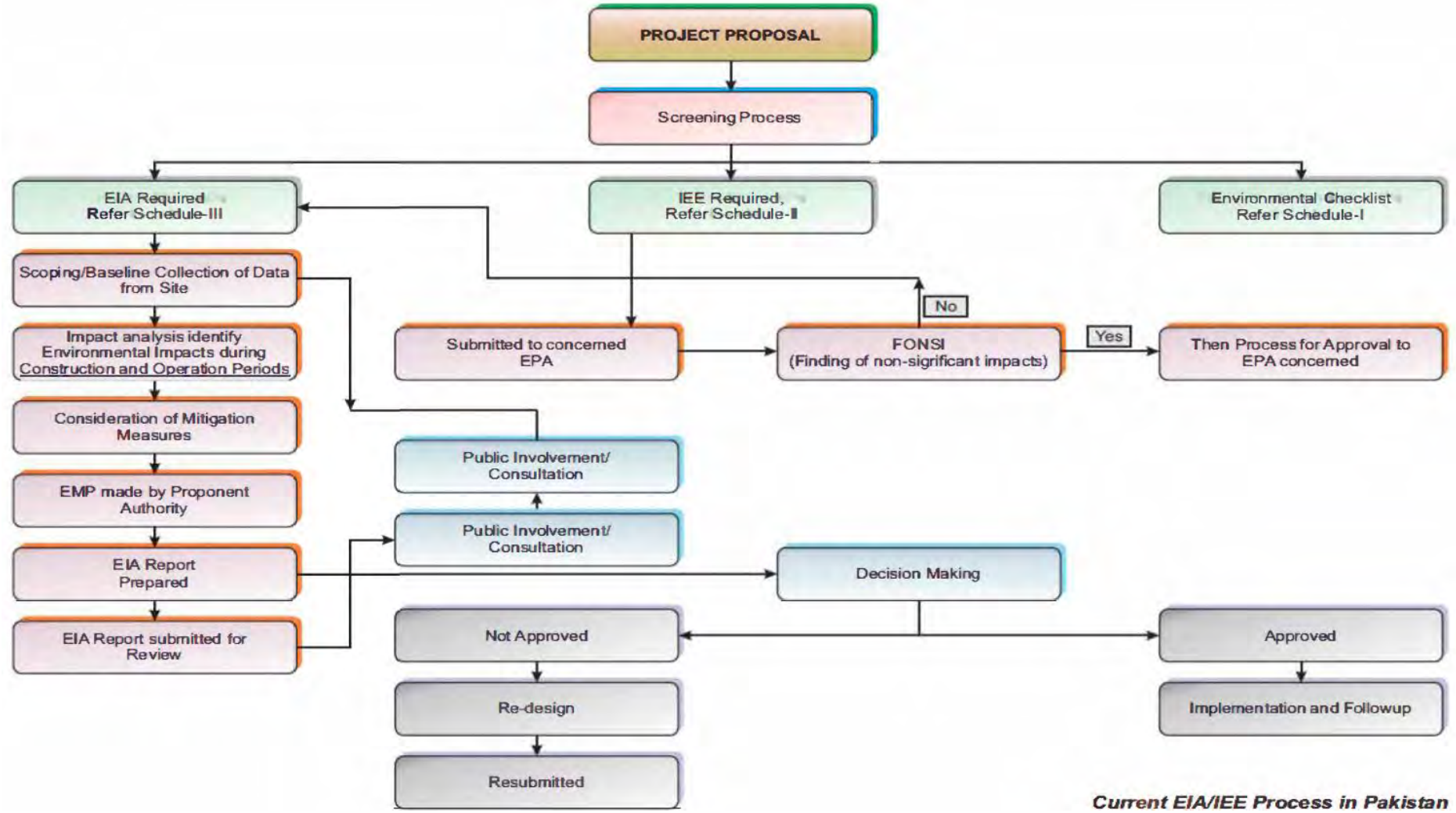


Figure 2.1: EIA and IEE Procedure in Pakistan

2.4 INTERNATIONAL PROTOCOL/CONVENTIONS

86. As Pakistan is a member of several international organizations such as United Nations Organization (UNO), Organization of the Islamic Cooperation (OIC), South Asian Association for Regional Cooperation (SAARC), Economic Cooperation Organization (ECO) etc., so it has to follow the international protocols and obligations related to the environment. The major protocols, ratification dates by Pakistan and obligations related to the proposed Project are provided in the **Table 2.10** below.

Table 2.3: International Agreements/Conventions Relevant to the Project

Sr. No.	Agreement/ Convention	Ratification	Description/Relevance
1.	UNESCO Convention on the Protection of the World's Cultural and Natural Heritage, 1972 Web Link: http://whc.unesco.org/en/%20convention%20text/	Pakistan ratified this convention on 23 July 1976.	Convention concerning the Protection of the World Cultural and Natural Heritage - requires parties to adopt a general policy on the protection of the natural and cultural heritage, to set up services for such protection, to develop scientific and technical studies, to take appropriate legal, technical, scientific and administrative measures and to foster training and education for such protection. The proposed Project design and EIA team paid due attention to archaeological sites and local norms. Both of these factors will also be considered during Project implementation.
2.	The Rio Declaration, 1992 Web Link: http://www.unesco.org/education/pdf/RIO_E.PDF	Pakistan signed the treaty on 13Jun 1992 and ratified on 1 June 1994	The Rio Declaration comprises 27 principles which address important issues such as; sustainable development to integrate environmental protection into the development process; common but differentiated responsibilities to conserve, protect and restore the earth's ecosystems; public participation and information access at the national level, reduce and eliminate unsustainable patterns of production and consumption.

Sr. No.	Agreement/ Convention	Ratification	Description/Relevance
3.	Kyoto Protocol, 1992 Web Link: https://unfccc.int/kyoto_protocol	Pakistan has ratified Kyoto Protocol in 2005	The Kyoto Protocol is a protocol to reduce Greenhouse gasses that cause climate change. It was agreed on 11th December, 1997 at the 3rd Conference of the countries to the treaty when they met in Kyoto, and entered into force on 16th February, 2005. As of November 2007, 175 countries have ratified the protocol. One hundred and thirty-seven (137) developing countries have ratified the protocol, including Brazil, China, India and Pakistan but have no obligation beyond monitoring and reporting emissions.
4.	Convention on Biological Diversity, 1994 Web Link: https://www.cbd.int/	Pakistan signed this treaty in 1992 and it was ratified by cabinet in 1994.	The Convention on the Biological Diversity (CBD) has three main goals: Conservation of biological diversity (or biodiversity); sustainable use of its components; and fair and equitable sharing of benefits arising from genetic resources.
5.	The Basel Convention, 1989 Web Link: http://www.basel.int/theconvention/overview/tabid/1271/default.aspx	Ratified 26th July 1994	Basel Convention on the control of trans-boundary movements of hazardous wastes and their disposal is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to Less Developed Countries (LDCs). It does not, however, address the movement of radioactive waste. The Convention is also intended to minimize the amount and toxicity of wastes generated, for environmentally sound management as closely as possible to the source of generation, and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate. The provisions of this convention imply to minimize the amount of waste generated and its management during construction and O&M phases.
6.	Stockholm Convention on Persistent Organic Pollutants (POPs), 2004	The Stockholm Convention on Persistent Organic Pollutants was signed	Convention seeks to protect human health and the environment from POPs as set out in Article 1, which are chemicals that remain intact in the

Sr. No.	Agreement/ Convention	Ratification	Description/Relevance
	Web Link: https://www.un.org/press/en/2004/unep204.doc.htm	on 22 May 2001 and entered in to force on 17 May, 2004. Pakistan signed the convention on December 6, 2001	environment for long periods, become widely distributed geographically and accumulate in the fatty tissue of humans and wildlife.
7.	Sustainable Development Goals (SDGs) – 2015-2030 Web Link: https://sustainabledevelopment.un.org/focussdgs.html	Pakistan was the first country to adopt SDGs 2030 agenda through a unanimous resolution of the Parliament of Pakistan.	The Sustainable Development Goals (SDGs) are a good collection of 17 global goals set by the United Nations in 2015. Pakistan has recently committed to Agenda 2030 and has become signatory to SDGs where Goal 6 calls, among others, for ensuring availability and sustainable management of water and sanitation for all, water use efficiency and integrated water resources management. The SDG 5 on gender equality and women's empowerment emphasizes to ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life.
8.	United Nation Framework Convention on Climate Change (UNFCCC), 1992 Web Link: https://unfccc.int/process-and-meetings/the-convention/status-of-ratification/status-of-ratification-of-the-convention	Signed on 13 Jun 1992 and ratified on 1 Jun 1994.	The UN Framework Convention on Climate Change (UNFCCC) is a multilateral agreement to address the issue of climate change. The Convention, was sets out and opened for signature at the June 1992 UN Conference on Environment and Development (UNCED), also known as the Rio Earth Summit. The UNFCCC entered into force on 21 March 1994. Pakistan being signatory of this treaty is bound to control the GHG emissions and climate change. Recent conference of parties (COP) for UNFCCC was held from 6 to 17 Nov, 2017 in Bonn Germany.
9.	Paris Agreement, 2016 Web Link: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement	Paris Agreement was signed on 22 April 2016 and ratified on 10 November 2016.	The Paris Agreement's long-term temperature goal is to keep the increase in global average temperature to well below 2 °C above pre-industrial levels; and to pursue efforts to limit the increase to 1.5 °C, recognizing that this would substantially reduce the risks and impacts of climate change. It also aims to increase the ability of parties to adapt

Sr. No.	Agreement/ Convention	Ratification	Description/Relevance
			to the adverse impacts of climate change, and make "finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development." Under the Paris Agreement, each country must determine, plan, and regularly report on the contribution that it undertakes to mitigate global warming.
10.	International Union for Conservation of Nature and Natural Resources Red List, 2000 Web Link: https://www.iucnredlist.org/		This enlists wildlife species experiencing various levels of threats internationally. Some of the species indicated in the IUCN red list are also present in the wetlands of Pakistan. However, no wildlife species experiencing various levels of threats are present in and around the surroundings of Project Area.
11.	Convention on the International Trade of Endangered Species (CITES), 1975 Web Link: https://www.cites.org/	Pakistan signed the Convention in 1973 and ratified it in April 1976.	The convention entered in to force on 1 July 1975. The principal obligations of contracting parties to the CITES are to safeguard the trade in rare or endangered species and it established a permit system to control imports and exports of wild fauna and flora. According to this convention, species threatened with extinction whose movement between countries is prohibited except for conservation purposes such as captive breeding, species whose commercial trade is permitted but export permits are needed. The proposed Project design and EIA team paid due attention to CITES (if applicable)
12.	Convention on Conservation of Migratory Species of Wild Animals, 1979 https://www.cms.int/	Pakistan signed this convention in 1981 and ratified it in December 1987.	Convention on the Conservation of Migratory Species deals with the conservation and protection of the migratory species. Species covered in the Convention should be given special attention during EA and monitoring and any impacts identified should be mitigated to acceptable levels (if applicable).

3 PROJECT DESCRIPTION

87. This section presents the technical details of proposed Project such as geometric design, right of way, pavement design, bridge design, associated structures, construction material, machinery and equipment required, Project cost and implementation schedule.

3.1 OBJECTIVES OF THE PROJECT

88. The main objectives of this Project are:

- To establish a direct southern transport link between the Karachi Port (including the allied facilities of SAPT, PICT, KICT and the Keamari Oil Terminal) to the Karachi – Hyderabad Motorway (M-9);
- To facilitate the movement of goods between Karachi Port and its allied facilities, Industrial Areas of Landhi and Korangi and the up-country locations;
- To provide a safer and faster link between the planned developments of the Education City, DHA City and Bahria Town along the Motorway M-9 in the Northern suburbs of the city to the main business center (CBD area) near the Karachi Port and also to the southern DHA and Clifton Areas;
- To link Malir Cantonment directly to the Karachi – Hyderabad Motorway (M-9) through a faster route for swift and easier movement of military troops in case of any emergency; and
- To help reduce traffic congestion, delays, economic losses, and environmental pollution on the city road network by exclusion of the external traffic i.e., traffic having both its origins and destinations outside the city or along its periphery, from the present routes to the proposed Malir Expressway.

3.2 PROJECT LOCATION

89. Project is in District Malir and Korangi of Karachi City of Sindh Province. The location map of the proposed Project Area is shown in **Figure 1.1.**

3.3 PROJECT ACCESSIBILITY

90. The proposed Project can be approached through various major roads and railway network from up country and down country. The proposed MEX is approachable through major roads such as Motorway (M9) - National Highway (N5) Link Road, Dumlottee Road, Malir River Road, Malir Dam Road, Malir Cantt Road, National Highway-Super Highway Link Road, Malir – Shah Latif Town Road, Sommo Goth Road, Malir River Bridge Road, Korangi Link Road, Korangi - Shah Faisal Road, Malir Right Bank Road, EMB Causeway, Shaheed-e-Milat Expressway and Korangi Road near KPT Interchange. The map showing accessibility along proposed expressway is shown in **Figure 3.1**.

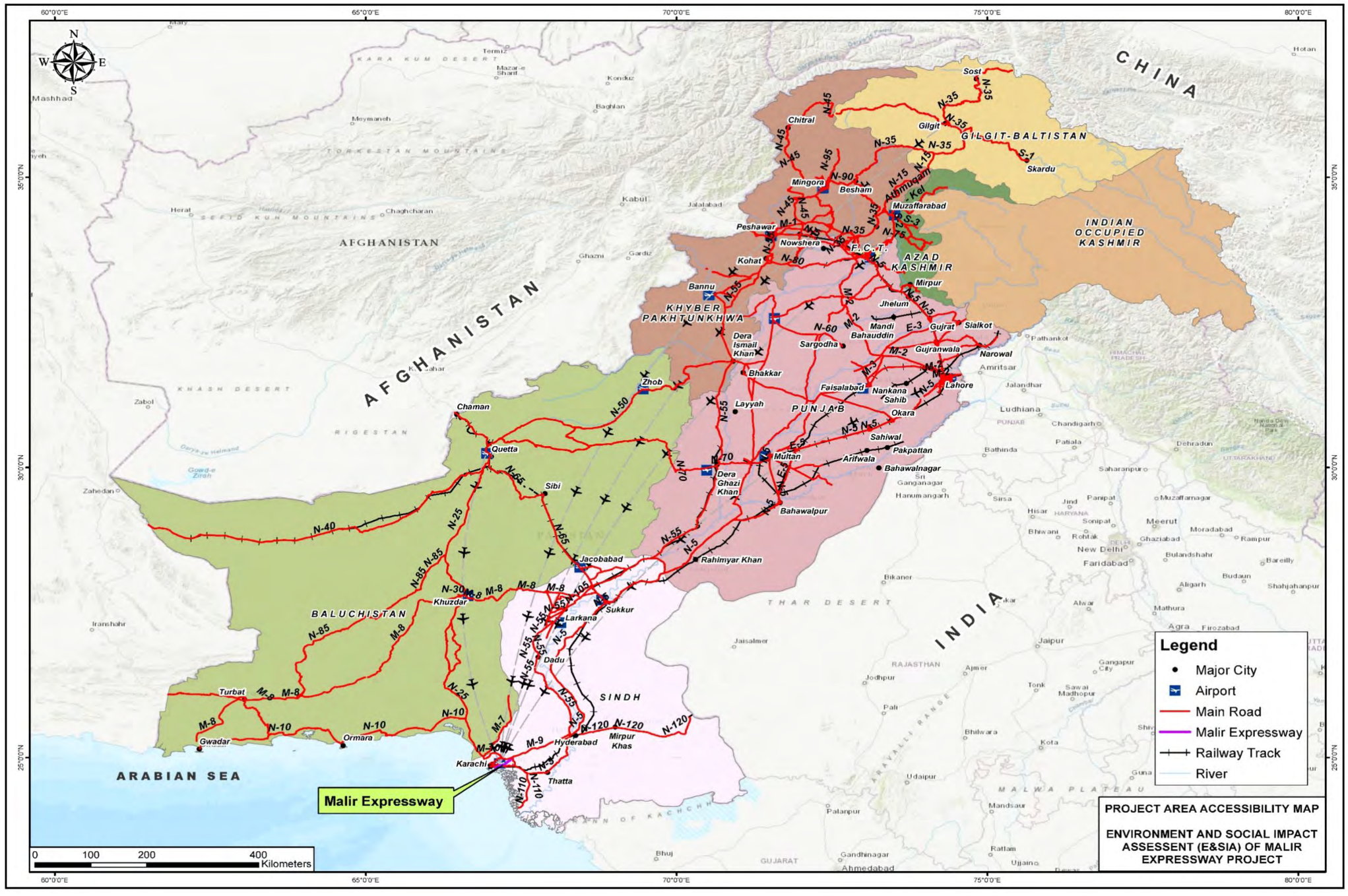


Figure 3.1: Project Accessibility Map

3.4 ALIGNMENT

91. The Malir Expressway Project shall be an Access-Controlled facility. It will start before the Jam Sadiq Bridge on Korangi Road, which is on Right Bank of Malir River, and will travel along the Malir River up to the existing Link Road between N-5 and M-9 (2.4 km short of M-9), at which point it will take a left turn to meet M-9 (Kathore), and serve as the end point of the Project, as shown in the Location Plan. The measured length of the expressway is 38.750 km. The existing section of the Link Road between N-5 and M-9 will need modification to meet the requirements of the Expressway according to given cross-sections. Similarly, the existing Trumpet Interchange on M-9 will also be modified to meet the design requirements of the Expressway.

92. Initially a four (4) lane divided cross section was being considered for the Expressway but later it was decided by the Government of Sindh in the Policy Board Meeting that there will be a Six (6) lane divided cross section for the Malir Expressway, keeping in view the road safety aspects/movement of light traffic alongside heavy traffic and future traffic requirements along the corridor.

3.5 PROJECT SALIENT FEATURES

The technical features and components of the proposed Project are as follows.

- MEX Length : 38.750 km
- Six (6) Lane Dual Carriageway with:
  - Main Carriageway : 2x10.95 m
  - Outer Shoulder on Either Side : 3.00 m
  - Inner Shoulder on Either Side : 1.20 m
  - New Jersey Median Barrier : 0.60 m
- No. of Interchanges (With Toll Collection Arrangement) : 05
- No. of Flyovers : 02
- No. of Toll Plazas (On Main Expressway) : 02
- No. of Cross-Drainage Culverts : 31
- No. of Underpasses : 4
- No. of Cattle Creeps : 8

3.6 DESIGN STANDARDS

93. The preliminary design is based on the following local and International Standards:

3.6.1 Geometric Design

94. A policy on Geometric Design for Highways and Streets (2011 Edition) published by American Association of State Highway and Transportation Officials (AASHTO).

3.6.2 Pavement Design

95. AASHTO Guide for the Design of Pavement Structures – 1993, and The Overseas Road Note –31: A Guide to the Structural Design of Bitumen Surfaced Rods in Tropical and Sub-Tropical Countries" published by Transport Research Laboratory (TRL), UK.

3.6.3 Materials and Testing

96. ASTM - American Society for Testing and Materials, &, AASHTO – American Association of State Highways Transportation Officials

3.6.4 Structure Design Standards

97. AASHTO Load Factor Resistance Design (LRFD)

Loading Criteria: West Pakistan Code of Practice for Highway Bridges 1967 and requirements of NHA.

Seismic Design: AASHTO analysis and design with latest Seismic Zoning Map for Pakistan as per revised current Government of Sindh (GoS) seismic parameters.

3.6.5 Traffic Control Devices

98. A Manual of Uniform Traffic Control Devices published by Highway Safety Wing, Ministry of Communications, Government of Pakistan.

3.7 GEOMETRIC DESIGN CRITERIA

99. The Geometric Design Criteria proposed to be adopted for the Project is based on the AASHTO Guide for the Design of Highways and Streets 2011 and include among others the following main elements as mentioned in **Table 3.1**:

Table 3.1: Geometric Design Criteria

Sr. No.	Criteria	Expressway	Interchanges
1	Design Speed	100 km/hr	40 km/hr
2	Max. Longitudinal Grade	3.0 %	4.0 %
3	Crossfall of Carriage Way Crossfall of Shoulders	2.0 % Outer Cross Slope 4.0 % Outer Cross Slope	2.0 % Outer Cross Slope 4.0 % Outer Cross Slope
4	Lane Width	3.65 m	3.5 m

Sr. No.	Criteria	Expressway	Interchanges
5	Outer Shoulder Width	3.0 m	0.50 m (Ramp / Loop / Slip Roads) and 1.20 m for Bridge
8	Inner Shoulder Width	1.20 m	0.50 m (Ramp / Loop / Slip Roads) and 1.20 m for Bridge
9	Shoulder Surfacing	Asphalt Concrete Wearing Course	Asphalt Concrete Wearing Course
10	Embankment Height	Min. 0.30 m above the HFL	Min. 0.30 m above the HFL
11	Embankment Side Slope	2H: 1V	2H: 1V

3.8 PAVEMENT DESIGN

100. The pavement designs have been carried out as per AASHTO Guide for Pavement Design (1993 edition) with load factors from National Transportation Research Center (NTRC) Report. The pavement design has been based on a minimum load of one hundred million (100,267,427 ESAL to be exact) Equivalent Single Axle Loads (ESALs) per Lane where the project has been designed for a design life of ten (10) years before any major maintenance is required. The design of the pavement has also been based on the soaked CBR (California Bearing Ratio) value of minimum 15% for subgrade compacted @ 95% of maximum dry density. Two overlays are envisaged for this Project with design lives of both the overlays as 10 years. The first one will be provided after 10 years of operation and the 2nd one, after another 10 years.

101. Overall, a design reliability of 95% has been adopted for the pavement design of the project road, where the design reliability refers to the degree of certainty that a given design alternative will last for the entire design period.

102. The serviceability of a pavement is defined as its ability to serve the type of traffic that uses the facility. Initial and terminal serviceability indexes have been established to compute the total change in serviceability that were used in the design equations, where both the initial and terminal serviceability indexes have been chosen as per AASHTO guidelines.

103. The identified set of pavement layers thickness, that will provide the required load carrying capacity, is determined by the design structural number (SN) of the pavement. Guidelines are provided in the AASHTO Guide for translating the structural number to layers thicknesses. All these aspects have been considered in the design of the flexible pavement, including drainage coefficients for each layer of the expressway.

104. After considering all above factors, the following thicknesses have been proposed for the carriageway:

Table 3.2 - Proposed Pavement Thickness for Carriageway

Layer	Proposed Thickness (cm)
Asphalt Wearing Course	5
Asphalt Base Course	16
Aggregate Base Course	30
Granular Sub-base Course	25
Subgrade (CBR ≥ 15%)	30

The design for the inner shoulder has been proposed to be like that of the main carriageway, whereas the design for the outer shoulder has been proposed as follows:

Table 3.3 - Outer Shoulder Thickness

Layer	Proposed Thickness (cm)
Asphalt Wearing Course	5
Aggregate Base Course	15
Subbase	56

105. The detailed pavement design report, outlining the detailed methodology of the design has been added as **Annex-III.**

3.9 EMBANKMENT DESIGN

106. The embankment design, its height, slopes, and protection work, including apron on river side, were designed keeping in view the outcome of Hydrology Study Report which was carried out for a (100) years Flood Return Period. Due consideration was given to Roadside Barriers at high embankment locations as per design standards. The standard flood estimates were analyzed using the 1) discharge frequency analysis using observed data, & 2) rainfall-runoff analysis.

107. In areas of high-water table, a filter cut-off layer will be provided to protect the pavement structure. This will include daylighting of the pavement layers to outer side of the embankment. In most cases, the embankment will be raised to 6.0 m as compared to adjoining areas, corresponding to flood extent ranging from 500-600m. Therefore, to ensure drainage from the road itself, drop structures are proposed to be provided at about 50 m apart with proper riprap arrangements to avoid any rill development of the embankment.

108. The embankment design is proposed with slopes having berm provision to withstand in such areas where soils are sand dominant, and settlement is a frequent phenomenon. A typical cross section is shown below (where on river sides, a proper treatment of base and stone pitching will be ensured with riprap arrangements):

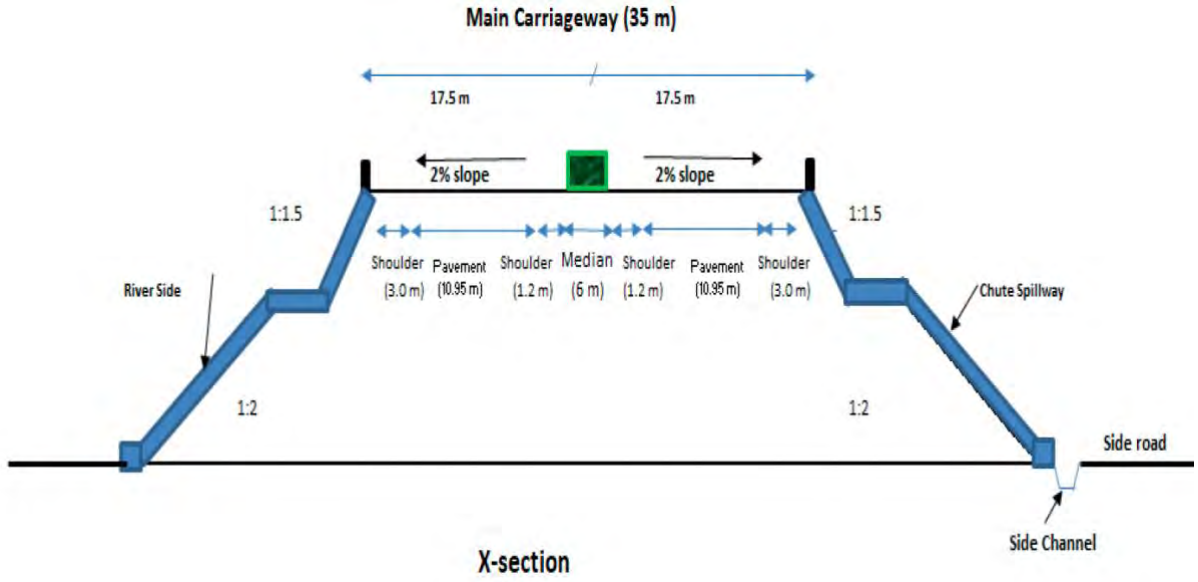


Figure 3.2 - Typical Cross Section of Embankment

Similarly, the design guidelines for various components of the chute spillway are also depicted below:

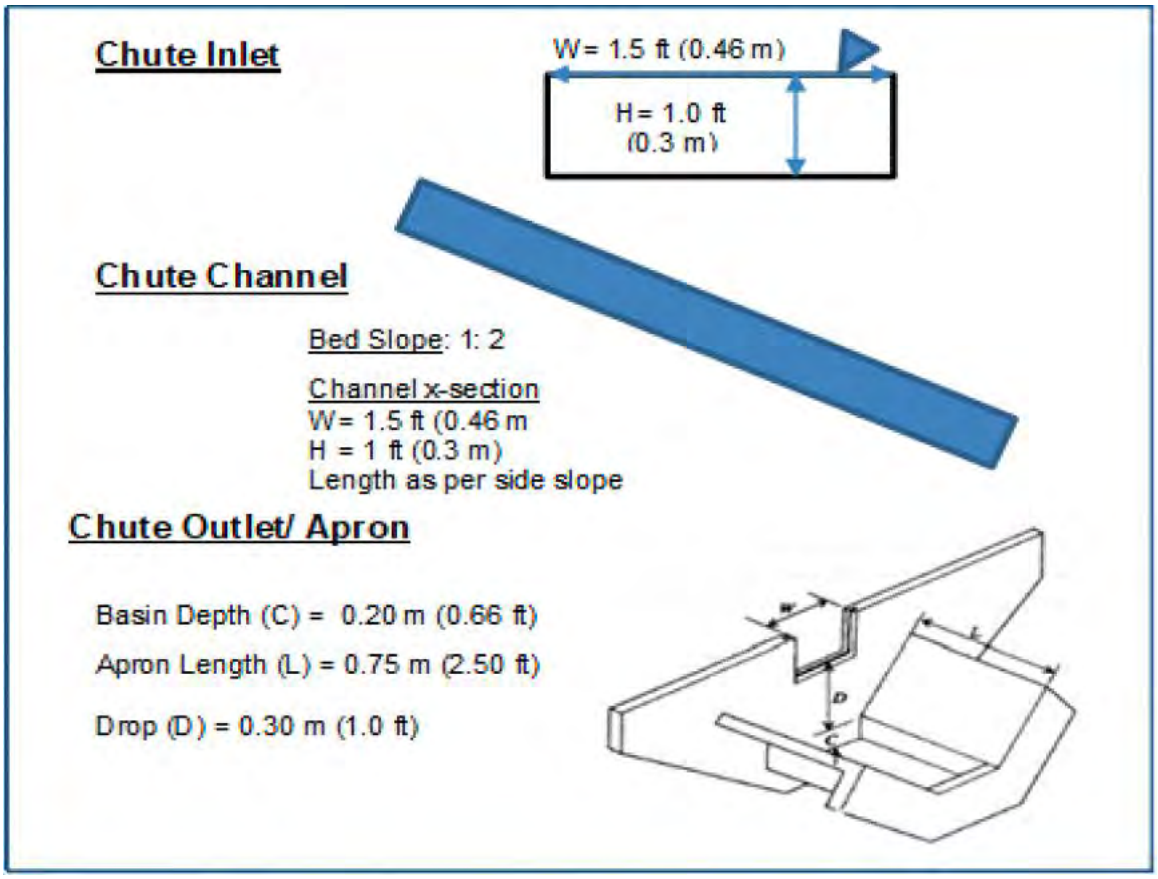


Figure 3.3 - Design Parameters of components for Chute Spillway

The detailed hydrological study is attached to the report as **Annex-IV.**

3.10 ELECTRICAL WORKS

109. The proposed Project, being an Urban Facility, will be provided with road lighting and the design of the lighting for the Expressway, interchanges, intersections, flyovers, toll plazas, toll buildings, control buildings and weigh bridges will be of approved illumination standards as per given technical specifications and standards.

3.11 TYPICAL CROSS SECTIONS

110. Keeping in view the functional requirements, the design criteria and the alignment characteristics, typical cross sections were developed for the various elements of the proposed Project including the main Expressway, the interchanges, bridges / flyover structures, underpasses and slip roads, etc. These cross sections are presented in the **Figure 3.4 to 3.5**. Furthermore, the detailed geometric design is attached to the report as **Annex-II**.

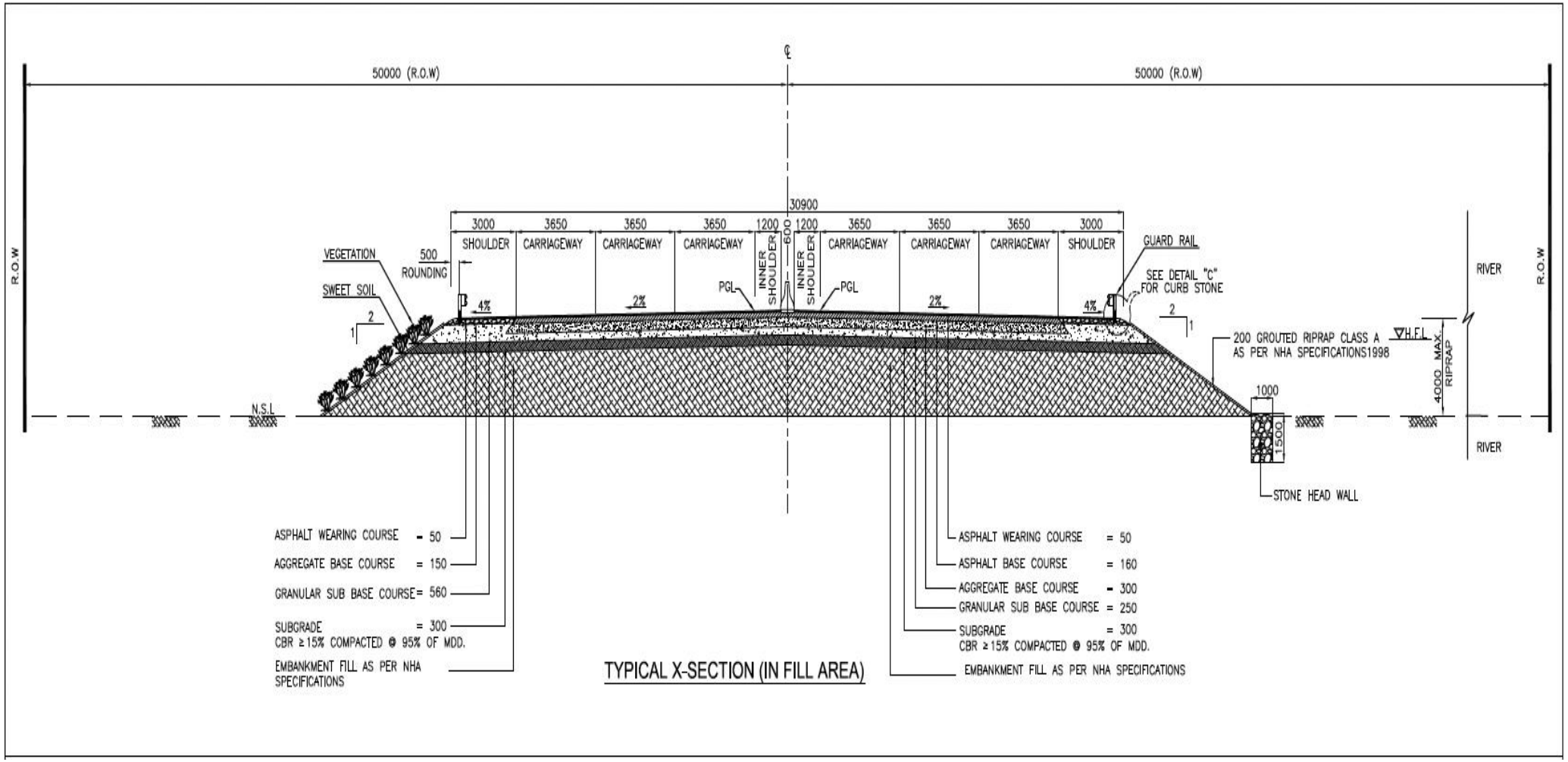


Figure 3.4 - Typical Cross Section - Carriageway (In Fill Area)

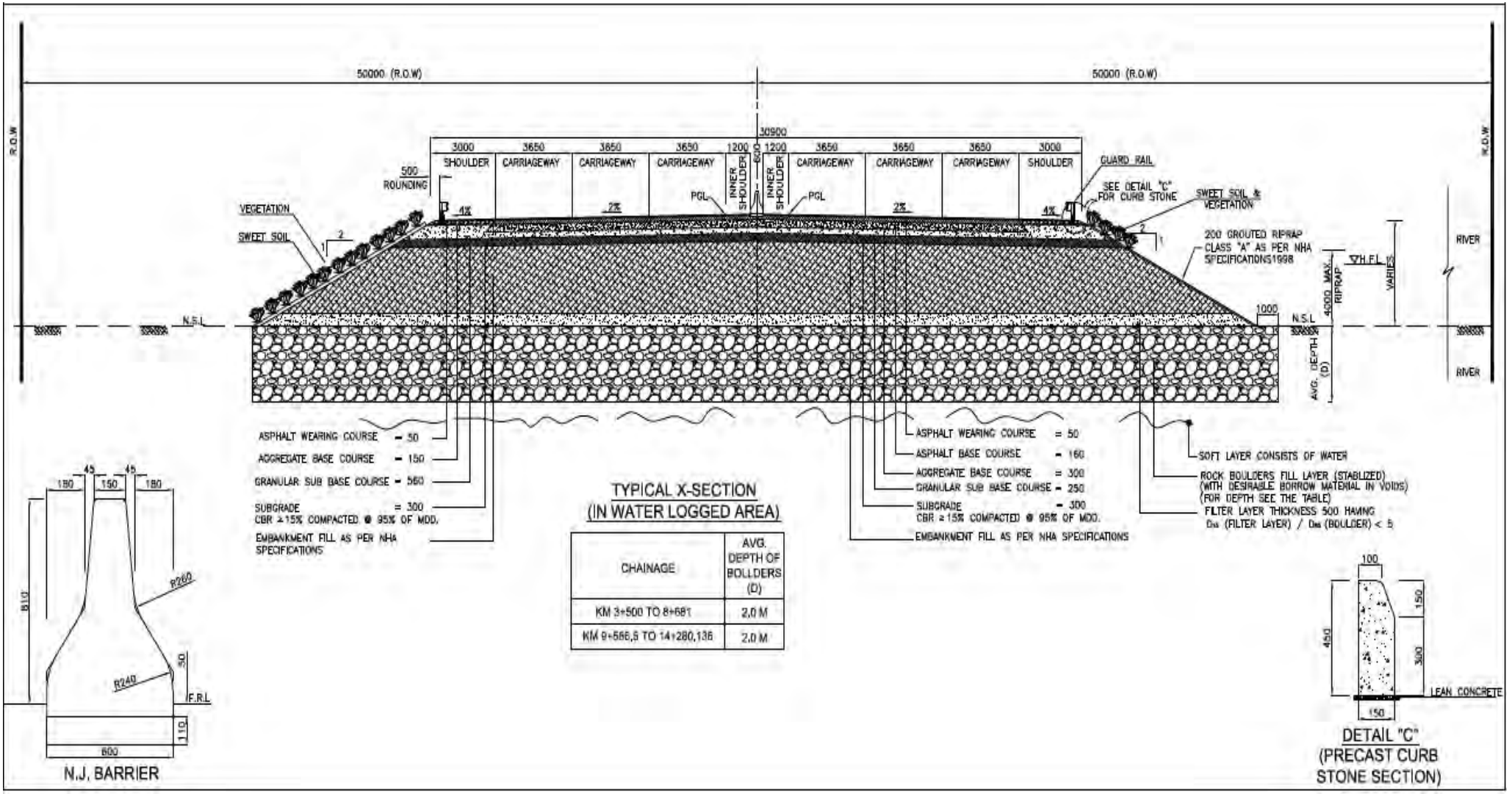


Figure 3.5 - Typical Cross Section - Carriageway (Water Logged Area)

3.12 INTERCHANGES EN-ROUTE

111. As per conceptual design of the proposed Malir Expressway, five (05) numbers of interchanges have been proposed at the following locations:

Table 3.4: Location of the Proposed Interchanges

Sr. No.	Project Component	Chainage (Start)	Chainage (End)
1	Jam Sadiq Interchange	0+205.1	0+355.38
2	EBM Causeway Interchange	2+991.72	3+031.43
3	Korangi – Shah Faisal Colony Interchange	9+179.8	9+330.2
4	Quaidabad Interchange on National Highway, N-5	14+912.88	15+417.51
5	Trumpet Interchange	23+916.5	23+941.5

3.13 PROPOSED LIST OF ASSOCIATED STRUCTURES

112. Numbers of associated structures are recommended for the proposed MEX. The list of these structures is mentioned in **Table 3.4.**

Table 3.5: List of Proposed Associated Structures

Sr. No.	Project Associated Structures	Numbers
1	Box Culverts	06
2	Pipe Culverts	25
3	Underpass	04
4	Cattle Creep	08
5	Nullah Bridge	04
6	Flyover	02

3.14 PROJECT COST

113. The total estimated cost of the proposed Project is Rs. 27.5 billion.

3.15 PROJECT ADMINISTRATIVE JURISDICTION

114. The proposed Project falls under the jurisdiction of Deputy Commissioners of Malir and Korangi Districts.

3.16 PROJECT IMPLEMENTATION SCHEDULE

115. The Project is scheduled to be completed in approximately 30 months.

3.17 CONSTRUCTION WORK FORCE

116. The Project involves professional, administrative, skilled, and unskilled labor which will be deployed for construction activities. About 900 numbers of crew, skilled and unskilled labor to be employed (of which 50% will be from neighboring localities) will depend on the Contractor's activity schedule at the time when the contract is awarded. The

Contractor will be advised to hire unskilled labor from the local communities. A training programme will be conducted for unskilled workers.

3.18 CONSTRUCTION ACTIVITIES AND REQUIRED MACHINERY

117. Construction activities of the MEX project will comprise of the following:

- Earth work of the Project Road and all associated works:
  - Removal of topsoil and clearing of vegetation/ trees.
  - Construction of embankments.
  - Construction of subgrade.
  - Excavation and removal of the existing pavement materials and the existing road embankment.
  - Removal and replacement of unsuitable materials.
  - Structural excavation.
  - Excavation for the construction of side drainage and cross-drainage works.
  - Excavation for the removal and relocation of the existing utilities.
  - All backfilling necessary for the construction of bridges, retaining walls or other earth retaining structures, cross drainage structures and associated works, side drains and erosion protection work.
  - Preparation of beddings and filters for all structural, cross drainage, side drains or pavement works.
  - Excavation, filling or backfilling necessary for the execution of any other incidental works.
- Pavement and roadwork (NGL embankment, preparation of sub grade, subbase, base and wearing course);
- The construction of the new bridge includes but is not limited to the following parts of the structures and associated works:
  - Foundations and pile work.
  - Substructure including bridge bearings.
  - Superstructure, including construction of expansion and deformation joints and footpaths.
  - Deck pavement including hydro isolation, drainage, hand railing, and conduits for services.
  - Approach slabs.
  - Slope treatments in front and around the abutments.
  - Construction and maintenance of traffic detours.
  - Scour and erosion protection of the waterway areas and riverbank protection upstream and downstream of the bridge crossing, and removal of old foundations and substructure from the waterways.
  - All necessary and incidental items required for a complete bridge.
- Allied/associated structure works of the project.

118. **Table 3.7** shows the list of expected list of machinery and equipment required for construction. The number of these machines will be finalized with the detailed design of the proposed road:

Table 3.6: List of Expected Machinery/Equipment

Sr. No.	Machinery and Equipment	Sr. No.	Machinery and Equipment
1	Dump Truck	12	Self-Propelled Pneumatic Roller
2	Front End Loader	13	Asphalt Distributor
3	Dozer	14	Batching Plants
4	Grader	15	Concrete Transit Truck
5	Vibratory Roller	16	Concrete Pump
6	Water Tankers	17	Excavator
7	Aggregate Spreader	18	Water Pumps
8	Three Wheel Steel Rollers	19	Cranes
9	Tandem Roller	20	Vibrators
10	Asphalt Batching Plant	21	Generators
11	Paver		

3.19 CONSTRUCTION MATERIALS

119. The materials used in construction of this road would include coarse aggregates (crush), fine aggregates (sand), soil, water, asphalt, reinforcement, cement etc. Almost all the raw materials are mostly locally available along or near to the alignment within Karachi city.

3.19.1 Concrete

120. Minimum compressive cylinder strength of concrete at 28 days for various structural works shall be as follows (as per international practices):

- Substructure of bridge — 280 Kg/cm^2 (4000 psi).
- Deck slab and diaphragms of bridge — 280 Kg/cm^2 (4000 psi).
- Piles — 280 Kg/cm^2 (4000 psi).
- Cast in-situ “I”/ Box Girder — 280 Kg/cm^2 (4000 psi).
- Precast Pre-stressed concrete — 350 Kg/cm^2 (5000 psi).
- Lean/Blinding concrete — 100 Kg/cm^2 (1500 psi)
- Substructure of culvert/underpass — 280 Kg/cm2 (4000 psi)
- Superstructure of culvert/underpass — 280 Kg/cm^2 (4000 psi)

3.19.2 Reinforcement

121. All reinforcing steel (deformed) to be used in reinforced concrete works will conform to ASTM A615 Grade 60 with minimum yield strength of 4250 kg/cm^2 (60,000 psi) or AASHTO M-31 Grade 60.

122. All pre-stressing steel shall be normal relaxation strand conforming to AASHTO M203 (ASTM A-416), Grade 270 having minimum ultimate tensile strength of 19000 N/mm2 (270 KSI).

3.20 CONSTRUCTION CAMPS

123. Camp sites will be selected based on following considerations:

- Number of workforces deployed;
- Type and quantity of machinery mobilized;
- Availability of adequate area for establishing camp sites including parking areas for machinery, stores and workshops;
- Access to communication and local markets and away from the local population settlements; and
- Appropriate distance from sensitive areas including settlements and religious and/or cultural facilities.

124. Based on the above criteria and consultant's experience, three (03) construction camps locations have been tentatively proposed. The location of these camps is shown in **Figure 3.6**.

125. Care will be taken to safeguard the existing environment of the area and location shall be selected away from settlements. The contractors may acquire land on lease from private landowners.

3.21 RESOURCE UTILIZATION

3.21.1 Water Requirement

The source of water during the construction phase will be from water bowser tanks and groundwater from local sources will be used. The water consumption is estimated to be 36,000 liters /day[2] for 900 construction workers for the proposed Project.

3.21.2 Wastewater Generation

The wastewater generation is estimated to be 28,800 liters/day for 900 construction workers of the proposed Project.

3.21.3 Solid Waste Estimation

Due to construction activities, waste will be generated at the construction site and contractors' camps. The contractor will provide the estimated quantity of excavation material during the construction phase, which will be generated due to the construction activities, where to the extent possible the excavated materials will be reused, where applicable, for construction purposes. Solid waste generated during construction and from camp sites shall be safely disposed in demarcated waste disposal sites.

The solid waste generation is estimated to be 450 kg/day (as per 0.5 kg/capita/day waste generation)[3] for 900 construction workers of the proposed Project.

2. Tentative Work Force Requirements refer section 3.22"
   = (900) x (40) = 36,000 liters/day
   = 80% of water consumption =28,800 liters/day (wastewater)

3. Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.5 kg/capita/day

3.21.4 Power Requirement/ Power Source

The main source of electricity/electric power during construction phase will be K-electric and diesel generators for construction camps and machinery, whereas during the operational phase it would be taken from the main electric power grid.

3.22 ROAD SAFETY

126. The following elements are provided for traffic control and security on road:

- Road signs and indicators;
- Fences;
- Signal posts;
- Traffic markings;
- Lighting;
- Traffic lights;
- Ground for short time stops for vehicles; and
- Sidewalks.

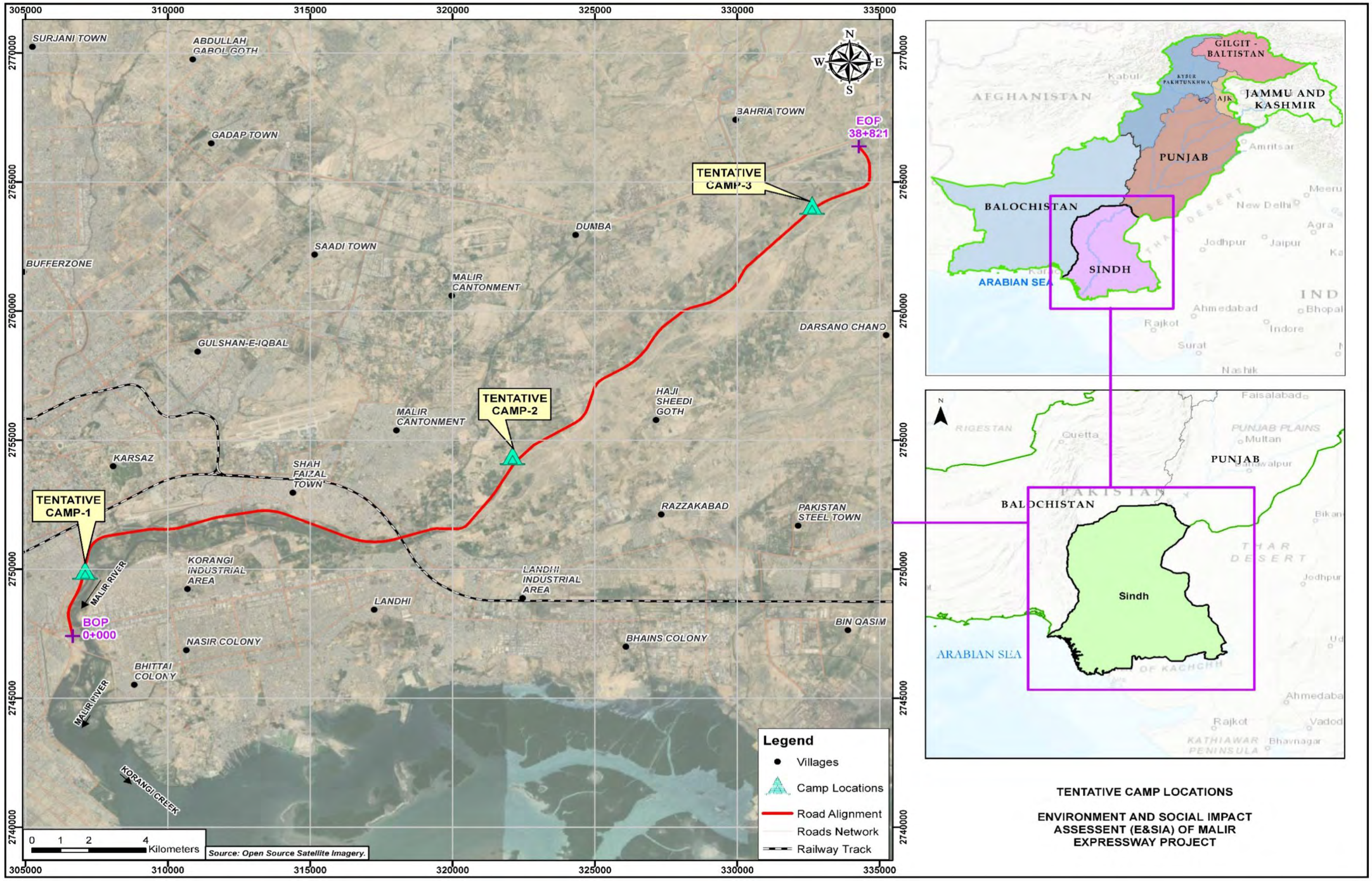


Figure 3.6: Location Map of Proposed Construction Camps

3.23 SPECIAL TRAFFIC GENERATORS FOR MALIR EXPRESSWAY PROJECT

127. The areas mentioned below contribute significantly to traffic in the city of Karachi, for which the Malir Expressway is being proposed as a solution:

- KPT (including the SAPT, KICT, PICT and the Oil Terminal at Shirin Jinnah Colony, Keamari);
- Port Qasim Authority and Steel Mills;
- DHA City;
- Bahria Town;
- Education City;
- Korangi Industrial Area;
- Landhi Industrial Area;
- Export Processing Zone (EPZ); and

3.24 TRAVEL DEMAND FORECAST FOR MALIR EXPRESSWAY

128. A well-conceived analytical framework was developed on the basis of available knowledge-base of the existing development pattern along the corridor, the historic / existing traffic volumes, congestion and delays on the road network in Karachi and the growing demand for another exclusive route for North – South connectivity, especially for the traffic between Karachi Port including SAPT, KCIT, PICT, Oil Terminal, Landhi / Korangi Industrial areas, the up-country, and also for linking the new developments in the Northern suburb with the city center (CBD area), DHA and Clifton areas in the South of the city. Accordingly, three mutually exclusive analysis scenarios were used for calculating the travel demand for the proposed Malir Expressway Project which are as below:

- The analysis scenario -1 presents an optimistic situation for the proposed Malir Expressway Project resulting in a higher traffic diversion to it;
- The analysis scenario -2 presents a Pessimistic Situation for the proposed Malir Expressway Project resulting in a lower traffic diversion to it; and
- As opposed to the above two extreme situations, the analysis scenario -3 presents a pragmatic situation for the proposed Malir Expressway Project resulting in a more realistic traffic diversion estimate for it.

129. The data collection exercise comprised the following activities in connection with this study:

- Collection of historic traffic data;
- Collection of other socio-economic data; and
- Fresh Traffic Surveys 2019 (Based on Origins – Destinations served by MEX).

130. Based on the above data and analysis, the travel demand volumes have been determined for the year 2019 and forecasts made for the years after under the three operational scenarios analyzed for the Project as shown in **Table 3.8.**

Table 3.7: Travel Demand Volumes for the Year 2019

Sr. No.	Details	Cars, Jeeps, SUVs, Vans	Buses and Minibuses	Truck and Trailer	Total Traffic Volume
Scenario -1					
1	Traffic Volume (Veh/ Day)	14,247	1,573	17,496	33,316
2	Travel Time Saved (Min/ Day)	403,865	14,557	107,073	525,495
Scenario -2					
1	Traffic Volume (Veh/ Day)	3,166	977	4,860	9,003
2	Travel Time Saved (Min/ Day)	89,748	9,041	29,743	128,532
Scenario -3					
1	Traffic Volume (Veh/ Day)	7,915	1,085	9,720	18,720
2	Travel Time Saved (Min/ Day)	224,370	10,041	59,485	293,895

131. After a detailed analysis of the previous trends of traffic growth in the city and the various factors likely to affect the growth of traffic on the proposed Project, the following traffic growth rates were applied for traffic projections (refer **Table 3.9).**

Table 3.8: Traffic Growth Rates Applied for Traffic Projections

Sr. No.	Year		Cars, Jeeps, SUVs, Vans	Buses and Minibuses	Truck and Trailer
1	2019	2020	5.0%	5.0%	5.0%
2	2021	2026	10.0%	4.0%	4.0%
3	2027	2036	6.0%	4.0%	4.0%
4	2037	2047	3.5%	3.5%	3.5%

132. Capacity analysis was performed based on procedures outlined in the Highway Capacity Manual, TRB, USA. It consisted in determination of the number of lanes required and the Level of service analysis for the three traffic scenarios for the 6-lane access-controlled facility.

133. The analysis for the earlier discussed three traffic scenarios are attached as **Annex-VI** A summary of the Levels of Service (LoS) in various years after construction under the three operational scenarios is presented below in **Table 3.10.**

Table 3.9: Summary of the Levels of Service (LoS) after Construction

Scenario	Year	Level of Service (LoS)
1	2023 – 2029	C
	2030 – 2033	D
	2034 onward	E
2	2023 – 2029	B
	2030 – 2037	C
	2038 – 2043	D
	2044 – 2047	E

Scenario	Year	Level of Service (LoS)
3	2023 – 2028	B
	2029 – 2036	C
	2037 – 2042	D
	2043 – 2047	E

134. Based on the foregoing Traffic Study, it is concluded that:

- Malir Expressway Project is amongst the important transport development projects for the city of Karachi as it would provide numerous benefits to the daily commuters especially between the southern parts of the city mainly Clifton and DHA to the Motorway M9 and beyond. It will essentially constitute the Southern Bypass for Karachi City;
- It will be more convenient and desirable for entry and exit from the central business area (CBD) for external traffic (i.e., traffic to/from outside the city) as compared to the urban arterials which remain congested during the day and are not suitable for movement of heavy traffic;
- It will also help improve the traffic conditions on the existing urban road network and its capacity by providing an exclusive alternate diversion route for the external traffic and by serving an estimated 42% of the population in various areas lying along the corridor serving as a bypass for the Southern half of the city;
- The traffic level on the proposed Malir Expressway will vary depending upon the operational scenario, transport infrastructure development policies in effect and the overall socio-economic and geopolitical conditions prevailing at the time of its completion and opening;
- According to the three operational scenarios envisaged for the proposed expressway, the total AADT will vary from 33,000vpd for the most optimistic scenario to 9,000vpd under the most pessimistic scenario. A more pragmatic estimate of travel demand along the proposed Expressway under the scenario-3 will be around 19,000vpd.
- The capacity analysis based on the procedures outlined in the Highway Capacity Manual, TRB, USA, shows that during the 25 years post construction analysis period, the Expressway will offer an acceptable Level of Service most of the time. However, towards the last few years the Level of Service may drop down to LoS “E” as highlighted above; and
- With the reduction in traffic on urban roads network due to shift of external traffic to Malir Expressway, there will also be a reduction in traffic accidents especially those involving the heavy goods vehicles.

4 PROJECT ALTERNATIVES

135. The analysis of various alternatives was carried out during the selection of the most feasible and viable route by the design team and the proponent keeping in view the technical, environmental, economic, and social constraints. The following alternatives were considered for the Project:

- No Project Option (NPO);
- Comparison of Widening of Existing Roads to Access the Required Destinations and
- Construction of New Malir Expressway.

4.1 NO PROJECT OPTION (NPO)

136. The Final Report of JICA Study 2012 for "Karachi Transport Improvement Plan" provides a comprehensive analysis of the transport systems environment in the city and was therefore duly referred during this study. According to this Report, Karachi's population is projected to grow from 18.9 million in 2010 to around 31.6 million in 2030 thereby making it the fastest growing city in the world.

137. This rapid increase in population has put a lot of pressure on the city's infrastructure especially the Urban Transport System (UTS)[4] which is not yet organized in a modern manner, and therefore barely caters to the mobility needs of the mega city. With limited infrastructure and low level of public services coupled with other factors such as weak traffic management, and a lack of a modern mass transit network, a rapid level of motorization of roads has been observed during the last two decades resulting in: severe traffic congestion, unnecessary delays, and noise and air pollution along the main corridors of travel in the city, impeding the economic efficiency and growth of the city.

138. In addition to the above, the Final Report of "Preparatory Survey on JICA Cooperation Program for Industry Development (Investment Climate Improvement in Karachi)" was also recommended for future development in "The Study for Karachi Transport Improvement Plan" by JICA.

139. Based on the above studies, the main problems of the transport system in Karachi can be summarized as follows:

- Inadequate growth of the transport infrastructure with respect to capacity and quality with respect to the increasing travel demand and expansion of the city in terms of population and area;
- Failure of the public transport system to cater for increased travel demand especially for the lower and middle income groups;
- Increase of private vehicles on roads, due to a dilapidated public transport system, leading to greater traffic congestion in the city; and

[4] *An urban transportation system can be defined as the set of transport infrastructures and modes that support urban movements of passengers and freight. It generally expresses the level of accessibility*

- No defined and well-connected outer ring roads to bypass this city congestion.

140. At present, Karachi has three main corridors linking it to rest of the country namely:

- The Karachi – Hyderabad Motorway (M-9) (Superhighway) / Shahrah-e-Pakistan corridor;
- The National Highway N-5 / Shahra-e-Faisal corridor and the RCD Highway; and
- N-25 / Hub River Road Corridor.

141. However, upon entering the urban limits of the city, these corridors become highly congested due to the increasing volume of traffic in the city, with a substantial volume of light vehicles and public transport vehicles alongside the frequent pedestrian movements across the roads, all of which disturb the smooth & uninterrupted flow of traffic.

142. Considering the above situation, the 'No Project Option' will result in further worsening of the present traffic conditions on intra city roads, with air and noise pollution increasing due to traffic congestions/bottlenecks and idling of engines due to traffic jams. Moreover, social impacts such as mental pressure, fatigue, and other associated health impacts (hypertension, asthma, etc.) due to extreme traffic congestion, air and noise pollution and delay in reaching destination will also play a part. The economic implications of the 'No Project Option' to the road users of Karachi City will also be detrimental, due to increased fuel consumptions, wear and tear of roads and vehicles, time delays, etc. will all form part of the 'No Project Option'.

4.2 COMPARISON OF WIDENING OF EXISTING ROADS TO ACCESS THE REQUIRED DESTINATIONS AND CONSTRUCTION OF NEW MALIR EXPRESSWAY

143. The major business as well as residential areas of Karachi such as Karachi Port, Industrial areas of Landhi and Korangi, the Central Business District Area, Clifton and DHA (Phase 1 to 8) and the proposed DHA City & the Education City can be accessed through existing roads such as Korangi Road, EBM Causeway Link, National Highway (N-5) near Quaidabad, Link Road between N-5 and M-9 and finally the Motorway (M-9) at the end point.

144. The competitive routes and relative distance savings via Malir Expressway for the same origins and destinations i.e., for trips between the Southern parts of the city in the vicinity of Karachi Port, DHA and Clifton, etc. and the North-Eastern parts i.e., DHA City, Bahria Town, the Karachi – Hyderabad Motorway (M-9) for onwards journey up-country, are summarized hereunder in **Table 4.1** and shown in **Figure 4.1.**

Table 4.1: Competitive Routes and Relative Distance Savings via Malir Expressway

Sr. No.	Existing Route from Keamari Port to the End Point of MEX	Existing Route Length (Km)	Relative Distance Saving via MEX (KM)
1	Keamari – Northern Bypass – Motorway (M-9)	87 (Green)	33
2	Keamari – SITE – Sharea Pakistan – Motorway (M-9)	60 (Blue)	06
3	Keamari – Mai Kolachi – Korangi Road – Link Road N-5 to M-9 Motorway	68 (Pink)	14
4	Keamari – Lyari Expressway – M-9	57(Orange)	03

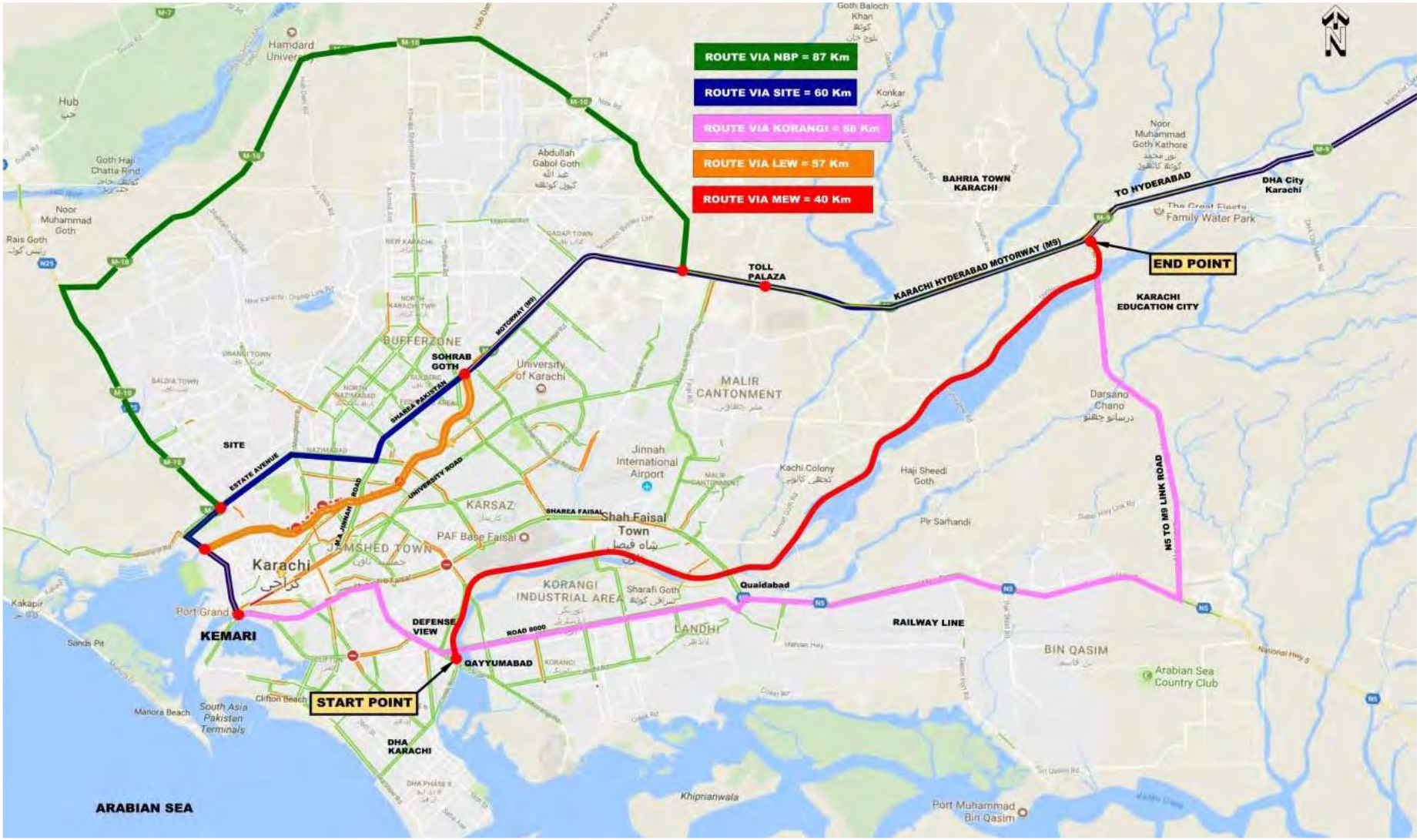


Figure 4.1: Comparative Routes and Relative Distance

145. The widening of these roads is not a feasible option due to the major commercial centers, housing societies, educational institutions and health facilities located along these roads, where widening would cause major land acquisition and resettlement issues along with considerable social as well as environmental impacts such as impact on roadside flora, traffic pressure due to diverted traffic on other roads, etc. Therefore, this option is not feasible in terms of the overall detrimental impacts.

4.3 MALIR EXPRESSWAY PROJECT (SELECTED OPTION)

146. Considering the above scenarios, the development of the Malir Expressway will cause the least environmental and social damages due to lesser travel distance and time, and limited land acquisition and resettlement issues. Furthermore, previous studies done in the area, have also emphasized on the development of this route (MEX) due to its strategic importance as this will substantially reduce the traffic load on adjacent feeder routes, while providing a link to important business hubs of the city. This expressway will also serve as a natural bund (due to embankments) to the seasonal urban floods in heavy monsoon rains, protecting the city from flooding. Due to these reasons, the MEX Project is the most preferred alternative out of all those available.

4.4 MEX ROUTE ALTERNATIVES

147. The MEX route selection is the process of selecting an optimized route for the construction of a proposed expressway between a defined start and end point, directly or via predetermined intermediate way points. Determination of the MEX route helps not only in minimizing any superfluous efforts but also in optimizing time and resources. The MEX route alignment has been finalized by considering the following features (where efforts have been made to avoid or minimize impacts to the environment and social aspects, as much as possible):
    - Optimize total expressway length;
    - Avoid game reserves, wildlife sanctuaries, national parks, reserved forests and ecologically sensitive areas (where possible);
    - Avoid Densely and sparsely populated areas, indigenous and tribal settlements and private/ Govt. infrastructures to the absolute extent possible;
    - No disturbance to the archaeological sites/ historical monuments (if any);
    - Graveyards, shrines and culturally important areas should be avoided and protected;
    - Avoid difficult terrain, extreme altitudes, steep slopes, landslides and unapproachable locations (where possible);
    - Proximity to existing highway/roads for ease of mobility, construction and maintenance access;
    - Avoid crossing over major water resources i.e. rivers, streams, etc.; and
    - Maintain adequate clearance from the public infrastructure and sensitive zones (especially Pakistan Air Force prohibited areas).

148. Based on the above-mentioned criteria, the proposed routes for the MEX have been shortlisted to two (02) routes, namely “Option A” and “Option B”, which are described below:

149. **Option A:** Prior to start of the field activities for route optimization of MEX, a tentative route with 39.5km length was marked on Google imagery by design experts while avoiding settlements, infrastructures, and forest areas to the extent possible. Route "A" is marked on **Figure 4.2**.

150. **Option B:** A team of experts comprising of environmentalists, sociologists and design experts traversed along route "A" for the purpose of route optimization by making physical, ecological, social and design observations along the site. The team evaluated this route by identifying various kinds of features with an emphasis on environmental parameters, settlements, social issues, and sensitive/prohibited zones, etc. It is noteworthy to mention that during the route optimization process, consideration was given to the shortest possible route along with accessible roads / paths nearby the proposed RoW to make the development as practical as possible based on technical and economical construction. A field reconnaissance visit was conducted for the verification of the proposed alignment "Route-B" which was obtained after Route A was optimized. Certain drawbacks in the proposed Option A alignment were noted during this field visit which are discussed below:

- From RD 3+100 to 4+500 the proposed Option A alignment was near to the PAF Faisal Base and from 5+600 to 8+200 the Option A alignment was closer to the Air Force shooting area. In this stretch, the alignment is optimized by shifting it away from these zone (alignment of Option B);
- From 16+000 to 17+500, the proposed Option A alignment crosses the densely populated zone of Sommo Goth, where the alignment was shifted to the east to avoid densely populated zones;
- From 20+000 to 21+100 and from 29+600 to 30+900, the proposed alignment of Option A was optimized to reduce the land acquisition and resettlement of project affected persons;
- Moreover, the additional cattle creeps for the crossings of animals and underpasses on existing tracks for the facilitation of locals were proposed.

151. The summary of alternative Option A and Option B of MEX is shown in **Table 4.2**.

Table 4.2: Summary of the MEX Routes Options*

Sr. No.	Parameter	Malir Expressway (MEX)	
		Option A	Option B
1.	MEX Length	39.5 km	38.75 km
2.	Cattle Creep	08	08
3.	Main Nullah Bridge/ Main Nullah Crossing	04	04
4.	Flyover	01	01
5.	Underpass	11	04
6.	Reserve / Protected Forests along the Route	00	00
7.	PAF Shooting Area Prohibited Zone	01	00
8.	Faisal Base Prohibited Zone	01	00
9.	Cultivated Land (Acres)	284	225

Sr. No.	Parameter	Malir Expressway (MEX)	
		Option A	Option B
10.	Structures (residential, commercial, religious, government and non-government fixtures and utilities)	480	434
11.	River Crossings	None	None
12.	Archaeological Sites / Historical Monuments	None	None

*Based on initial surveys, an accurate estimation of these figures will be obtained once the Revenue Department finalizes Section IV of the Land Acquisition Act. An accurate figure will be provided in the Land Acquisition and Resettlement Plan being prepared separately.

152. Considering the above optimizations in the proposed alignment of Option A, Option B was finalized as it will cause relatively less environmental and social damages due to lesser travel distance and time and lesser relative land acquisition and resettlement issues.

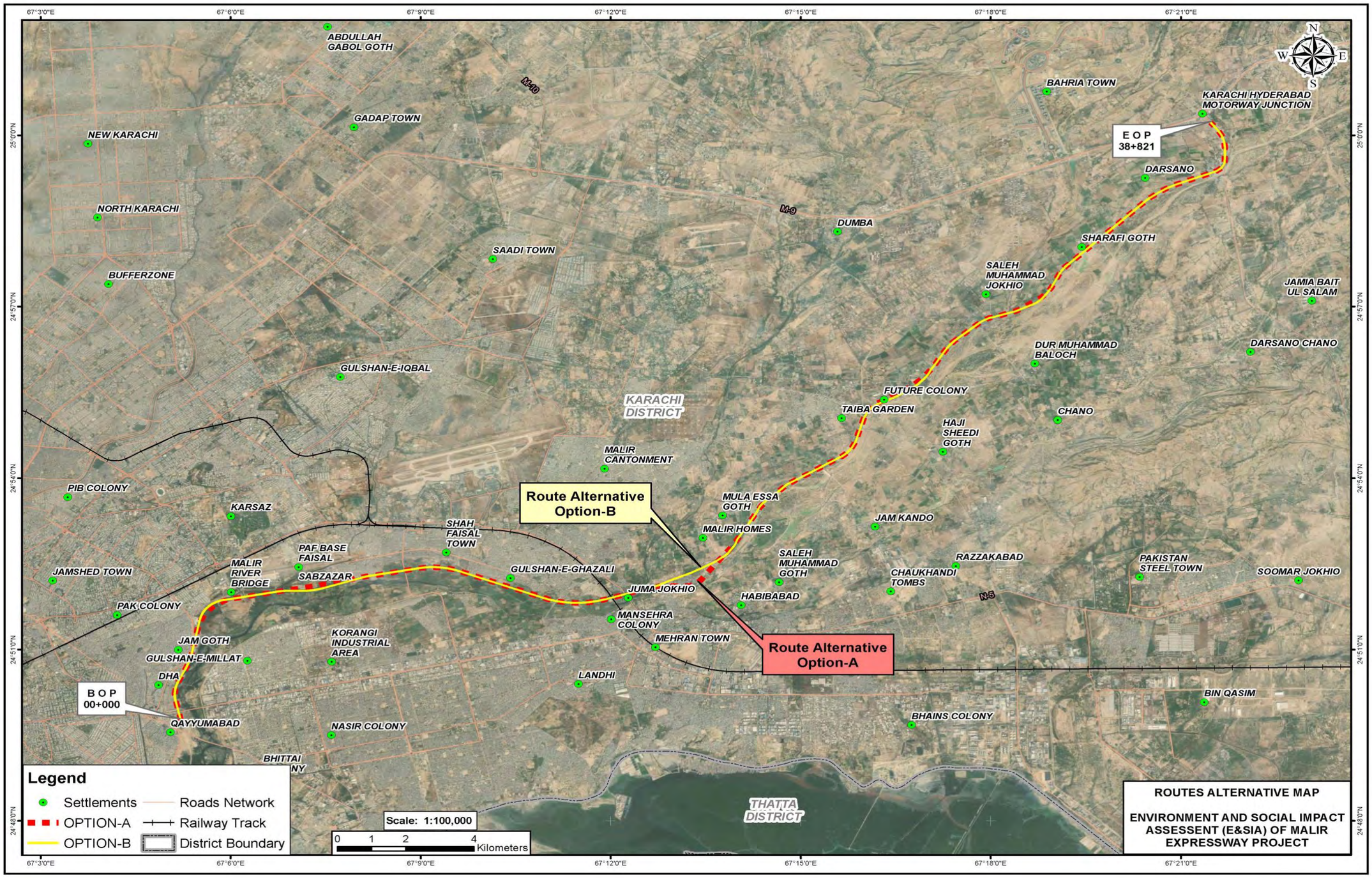


Figure 4.2: MEX Route Alternative Options

4.5 CONSTRUCTION CAMP SITE ALTERNATIVES

153. The team has identified a total four (04) number of construction camp sites along the proposed MEX project which were further screened by the environment and social experts keeping in view the following guidelines:

- There should be no resettlement issues in the location of the camps;
- Camp sites should be away from residential areas and sensitive receptors;
- Construction camp sites shall be near the Project Area, with proper access to the nearby main/link road;
- The camps must be located in a place where the drainage from and through the camps will not threaten any domestic or public water supply;
- The camp site must be adequate in size to prevent overcrowding of necessary structures
- The camp site should consider avoiding any damage of property, vegetation, irrigation, and drinking water supply systems already existing in the area;
- The camp site must not be subject to periodic flooding; and
- There should not be any ecological sensitive areas e.g. wildlife sanctuaries, game reserves, national parks, forest areas, etc. near to the construction camp site.

154. A comparison of proposed construction camp alternatives is provided in **Table 4.3**. Based on the comparative assessment, three (03) construction camps were finalized which have better access to the main / link roads and no resettlement issues are involved. The locations of these recommended construction campsites have been provided in **Figure 3.6**.

4.6 CONSTRUCTION ALTERNATIVE

155. Road construction is a major construction activity. The two most common materials used for pavement construction are asphalt and cement concrete. The proposed MEX Project will be an asphalt-based pavement as proposed by the Design Consultant. However, the option of concrete is also available. Both options have certain advantages and disadvantages with its application. The comparison of both with respect to environmental and quality constraints are provided hereunder:

Asphalt	Concrete
Advantages	
• New asphalt is quieter than concrete. Though it creates a smooth drive, it also boasts better traction and skid resistance. • Asphalt is 100% recyclable. When melted down, it can be used again to create new roadways • Since asphalt is black, it utilizes the natural heat from the sun to help keep the roads clear after storms. Heat absorbing into asphalt creates an ideal atmosphere for moisture evaporation.	• The biggest benefit of concrete road construction is the longevity. Lasting 20-40 years on average, paving in concrete can boast two to four times the lifespan of asphalt. • Concrete is recyclable. Once crushed into gravel, concrete can be used in a variety of ways. • High truck volume is better suited to concrete roads, as they hold up better under the weight and pressure. • Concrete tends to be a greener material. Producing it creates less environmental pollution, and cars run with better fuel efficiency on concrete. Concrete is also produced from limestone, which is widely available.
Disadvantages	
• The process of melting asphalt creates greenhouses gasses, which contribute to environmental pollution. This happens regardless of new production or recycling. • Asphalt is a cheaper and faster solution for short-term projects, but the repairs are sometimes just as extensive as concrete. With only a 10-year lifespan, asphalt must be re-laid or repaired on a much more regular basis.	• Concrete doesn't always make for a smooth ride. In order to create enough grip on the road, texture is brushed into the surface. This, and slabs settling over time, can make for a somewhat bumpy and noisy roadway. • Though concrete lasts a long time, repairing it is a bigger chore. Holes or cracks can't be simply patched--instead, entire slabs must be replaced. • The costs of concrete roads are also higher than that of asphalt, both in installation and repair. • Concrete is not as "grippy" as asphalt, either. Spills, vehicle chemicals, and other pollutants do not absorb into concrete as well as asphalt. This material is also more prone to slippage during rain.

156. Determining which type of pavement is more environmentally and cost effective is a difficult process which will never be 100% accurate, due to varying stress loads and environmental damage that will occur over time. Establishing the impacts of resource use and waste outputs on sustainable development is a difficult task and requires a life cycle assessment.

157. The two types of pavements were compared above based on a summary of the respective environmental effects. It would be more realistic to compare the annualized environmental burdens, considering the expected service life or durability of the two pavement types, however, the design life of pavements depends on many local factors, such as climate, traffic types and volumes, and quality of work, materials, sub-base, and so forth.

158. Based on the above analysis, the design consultant has proposed the asphalt-based pavement solution.

Table 4.3: Comparison of Construction Camp Sites

Sr. No.	Camp Location	Construction Camp Criteria							Remarks
		Resettlement Issues	Nearby Houses	Accessibility	Land Availability	Periodic Flooding	Ecological Sensitivity	Other	
1.	Near RD-2+800	No	No	EBM Causeway connected Shaheed e Millat Road and Main Korangi Road	Yes	No	Few Trees/ Plants	No (Barren Land)	Recommended
2.	Near RD 13+350	No	Yes	Korangi Link Road connected to N5	Yes	No	Few Trees	Agriculture Land	Not Recommended
3.	Near RD 24+000	No	No	National Highway – Superhighway Link road connected to Memon Goth Road	Yes	No	No Trees	No (Barren Land)	Recommended
4.	Near RD 35+300	No	No	Dumlottee Road to M9-N5 Link Road	Yes	No	No	No (Barren Land)	Recommended

5 DESCRIPTION OF THE ENVIRONMENT

5.1 GENERAL

159. This chapter provides the preliminary level description of the baseline conditions within the Corridor of Impact (CoI) of the proposed Project in Karachi. The existing environmental and socio-economic settings of the proposed Project's CoI is considered as a benchmark for comparison of the physical, ecological, and socio-economic conditions before and after construction and during operational phases of the Project. This baseline provides the datum for identification of impacts at various phases of the Project activities.

5.2 RECONNAISSANCE AND DETAILED FIELD VISIT

160. The NESPAK team conducted site reconnaissance, where the major objective of the reconnaissance field visits was to familiarize with the environment in general and main outcome was refinement of limits of RoW and CoI. Furthermore, the stakeholder consultation and the acquisition of secondary data/information was also carried out for deification of impacts at scoping stage.

161. The major objective of the field visits was to collect the baseline data on physical, eco-biological and social aspects along with identification, assessment, and categorization of the significant environmental and social impacts of the proposed bypass. The secondary data was collected from published sources/reports and relevant departments, which were also verified through visual observations during reconnaissance, route optimization and detailed surveys. The photo log of the reconnaissance and detailed site visit is attached as **Annex -XX**.

5.3 AREA OF INFLUENCE (AOI) AND CORRIDOR OF IMPACT (COI)

162. In this report, the Area of Influence (AoI) is referred where the potential impacts of the proposed Project are anticipated. Since the Project is essentially a liner Project hence the AoI includes the CoI, a tripe along the road alignment where proposed Project activities potential impact (direct and indirect) will be considered. Potential significant impacts of the Project due to its non-linear components such as Construction Camps, Batching Plant Area, etc. are considered in the AoI as they may occur outside the CoI. The limits of the AoI are generally based on the Project's direct and indirect potentially significant impacts on bio-physical and socio-economic features and understanding of the route alignment of the proposed Project. The terms CoI and AoI are interchangeably used in this report.

5.3.1 Delineation of Corridor of Impact (CoI)

163. Keeping in view the national regulatory requirements, impacts and risks have been identified and analyzed within the Project CoI. The CoI of the Project encompasses

primary Project site(s) and related facilities that the Executing Agency develops or controls, such as expressway route, its components, interchange areas, access roads, borrow pits, disposal areas and construction camps. The CoI does not include potential impacts that might occur without the Project or independently of the Project. Environmental impacts and risks will also be identified and analyzed for all relevant stages of the Project cycle, including pre-construction, construction, and operational phases of the Project.

164. The CoI includes the actual RoW of the Project as well as the surrounding areas where positive and adverse impacts may be foreseen due to the implementation of the proposed Project. RoW of the proposed Malir Expressway from the center line is 50 meters on either side. CoI is taken 50 meters from the center line on both sides also, as the width of the road is roughly 27 meters on either side of the centerline (including embankment). The RoW and CoI Index Map is shown in **Figure 5.1.**

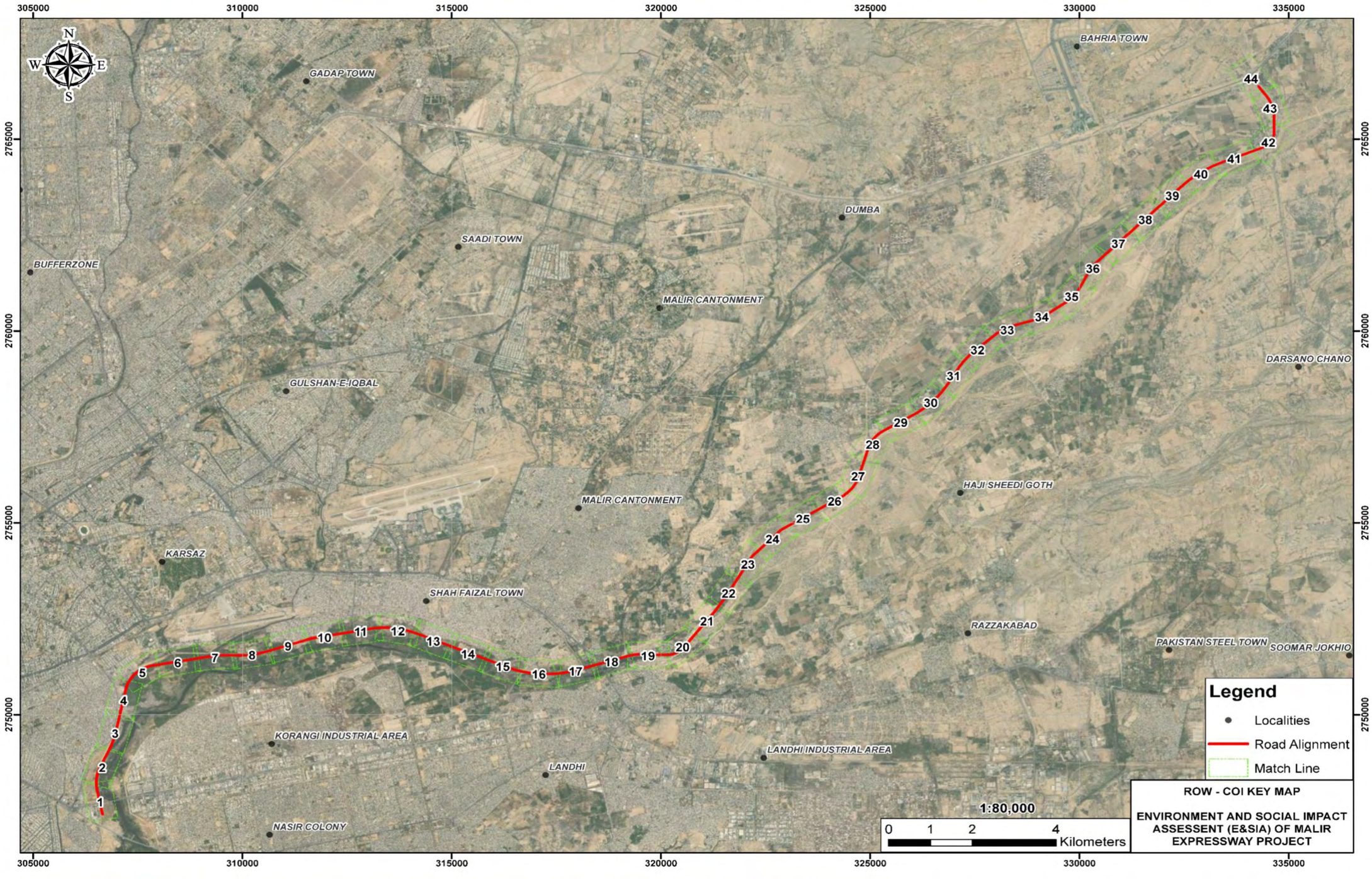


Figure 5.1: RoW and CoI Index Map of the Proposed Malir Expressway

5.4 PHYSICAL ENVIRONMENT

165. The following section provides an overview of the information on the physical environment of the CoI compiled through primary as well as secondary sources. The major parameters covered include Topography, Geology, Seismicity, Climate, Water Resources, and Land Use within the CoI of the proposed Project.

5.4.1 Topography and Physiography

166. The proposed Project Area is in Karachi, the south of Sindh. The terrain morphology along the proposed route comprises predominantly of flat terrain with small sections of ridges and slopes in Malir and Korangi Districts. The physiographic features of the Project Area are divided into two broad categories: Hilly Region (Mountain Highland) and Alluvial Plain (Piedmont Plain). The highest elevation of land along the proposed expressway is 100 meters above mean sea level (amsl) and the lowest is 05 meters amsl. The elevation profile along the proposed route is shown in **Figure 5.2**.

167. Presently there is no road along the Malir River, however, on both Banks of the river, protection bunds are available up to National Highway N-5. Using the right bank, light vehicles can travel along the river, however, the right bank protection does not continue in a stretch. The River width i.e. bund to bund distance is variable between 300m to 2,000m, at various locations throughout the river. The Malir Expressway is proposed on the Right Bank of the Malir River, because of availability of land, better geometry, and access to several populated areas. Most of the influence area of this MEX is cultivated or barren, however, few residential colonies are encountered in the proposed alignment.

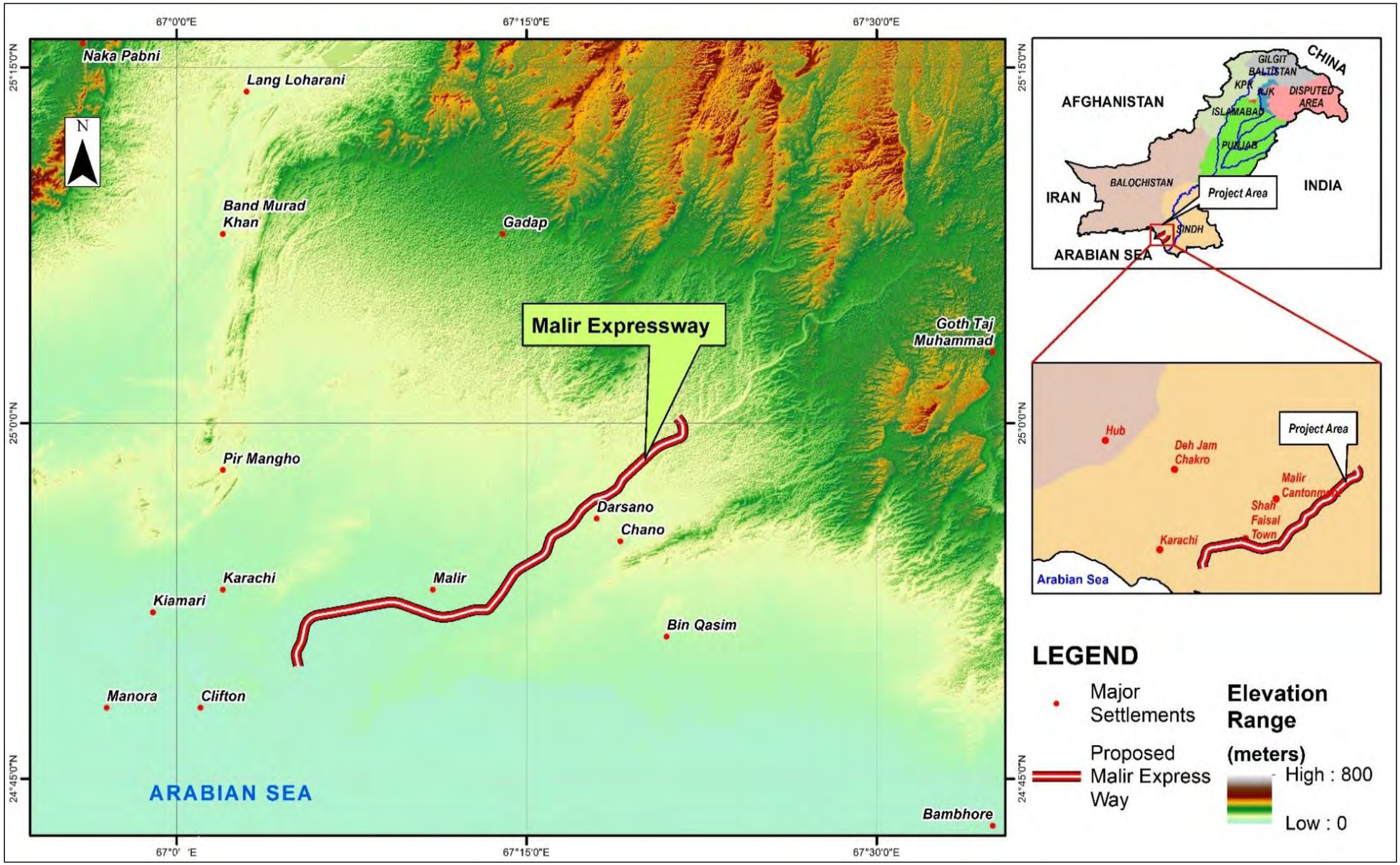


Figure 5.2: Project Area Elevation Map

5.4.2 Regional and Site-Specific Geology

168. The geological studies[5] have revealed that the formations in this area are fresh and slightly weathered, with recent and subrecent shoreline deposits. These deposits are derived from the Gaj / Manchar formation of the lower Moicene to Middle / Upper Miocene to Pliocene era. Quarternary deposits are represented by an extensive Conglomerate which unconformably overlies the Manchar rocks and slightly overlaps on to the Gaj series. Alluvial sands and gravels in the area are of comparatively `Recent' origin. The Gaj formation consists of mostly limestone with subordinate shale and sandstone. The limestone is friable, to hard, and at placed fossiliferious. This formation overlies Nari formation which consists of harder limestone beds and shale. Overlying Gaj formation is Manchhar formation. This formation is composed of sandstone, clay beds, cemented sand, and gravel (Conglomerate) and shell concrete. The clays are of various colors and consistency. Sandy layers are also found interbedded with clay and gravel.

169. The geology of the proposed Project Area falls in the Holocene category, where surficial deposits comprise of unconsolidated deposits of clay, gravel and morains, along with Miocene Rock Gaj Formations which comprises mainly marine shales and limestone, fossiliferous, topmost sandstone, and shales estuarine with abundant molluscan and few vertebrate fauna, early miocene. These deposits are derived from Gaj / Manchar formation of Lower Moicene to Middle / Upper Miocene to Pliocene age. The site-specific Geological Map of the area is shown in **Figure 5.3**.

[5] *Geological Investigation Report of MEX (2019)*

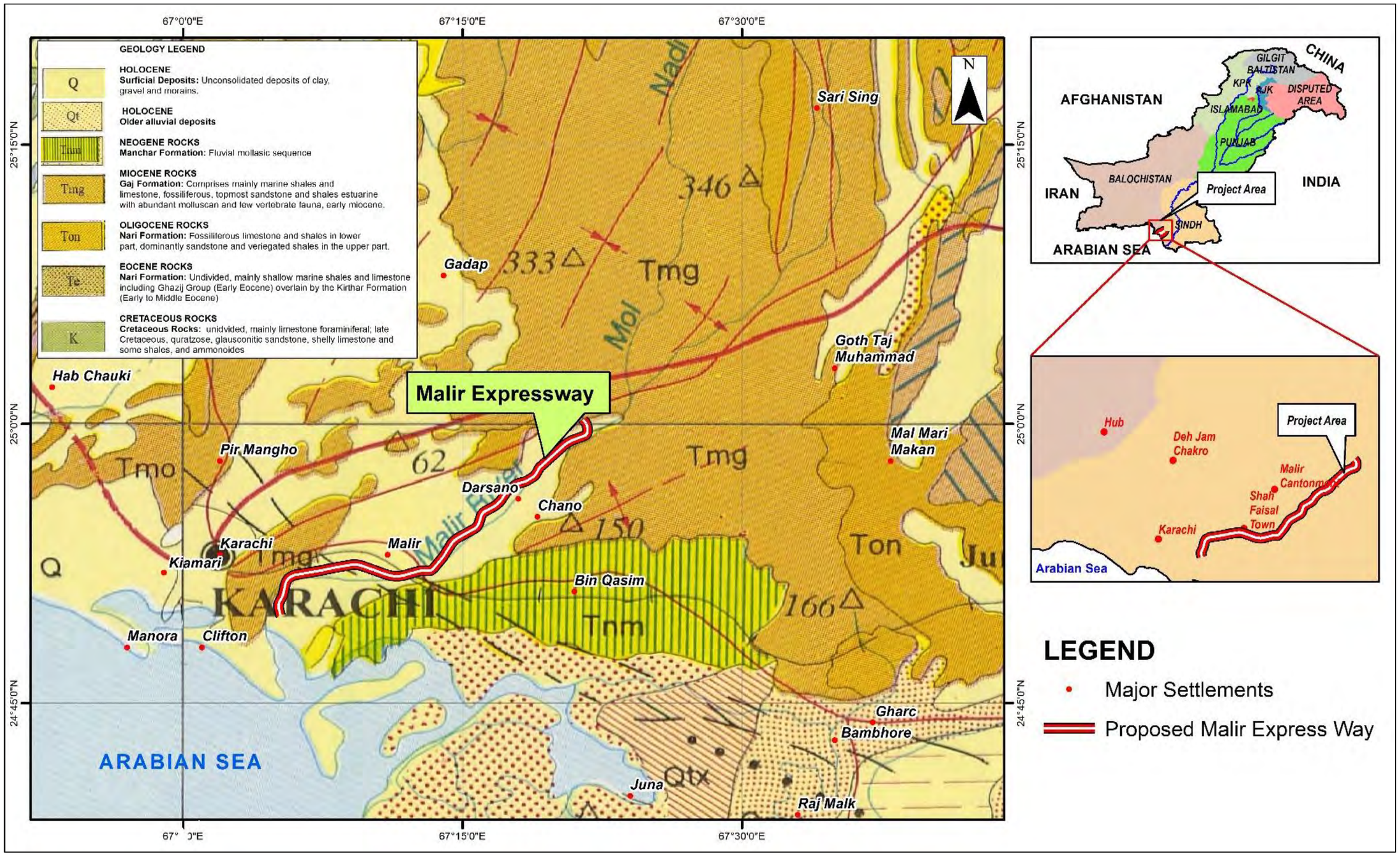


Figure 5.3: Project Area Geological Map

5.4.3 Seismology

170. The Seismo-tectonics of Pakistan are governed by the interaction of the following three lithospheric plates: Indian, Arabian, and Eurasian Plate. Tectonically, 75% of Pakistan lies on fault lines. The proposed Project is situated close to the junction of three tectonic plates (Indo-Pakistan, Arabian and Eurasian Plates), however, that can be attributed to it being in Karachi, as almost the entire city lies in the same scenario. The significant faults in the vicinity include Ran of Katch Fault in east and Pub-Null Fault in west. The Rann of Kutch-Karachi fault, also known as Karachi-Jati-Allah Bund fault, passes close by the Eastern Industrial Zone of Port Qasim. It has three other segments namely the Jhimpir fault, the Pab fault, and the Surjani fault.

171. **Figure 5.4** shows the location of Karachi with respect to Tectonic Plate Boundaries.

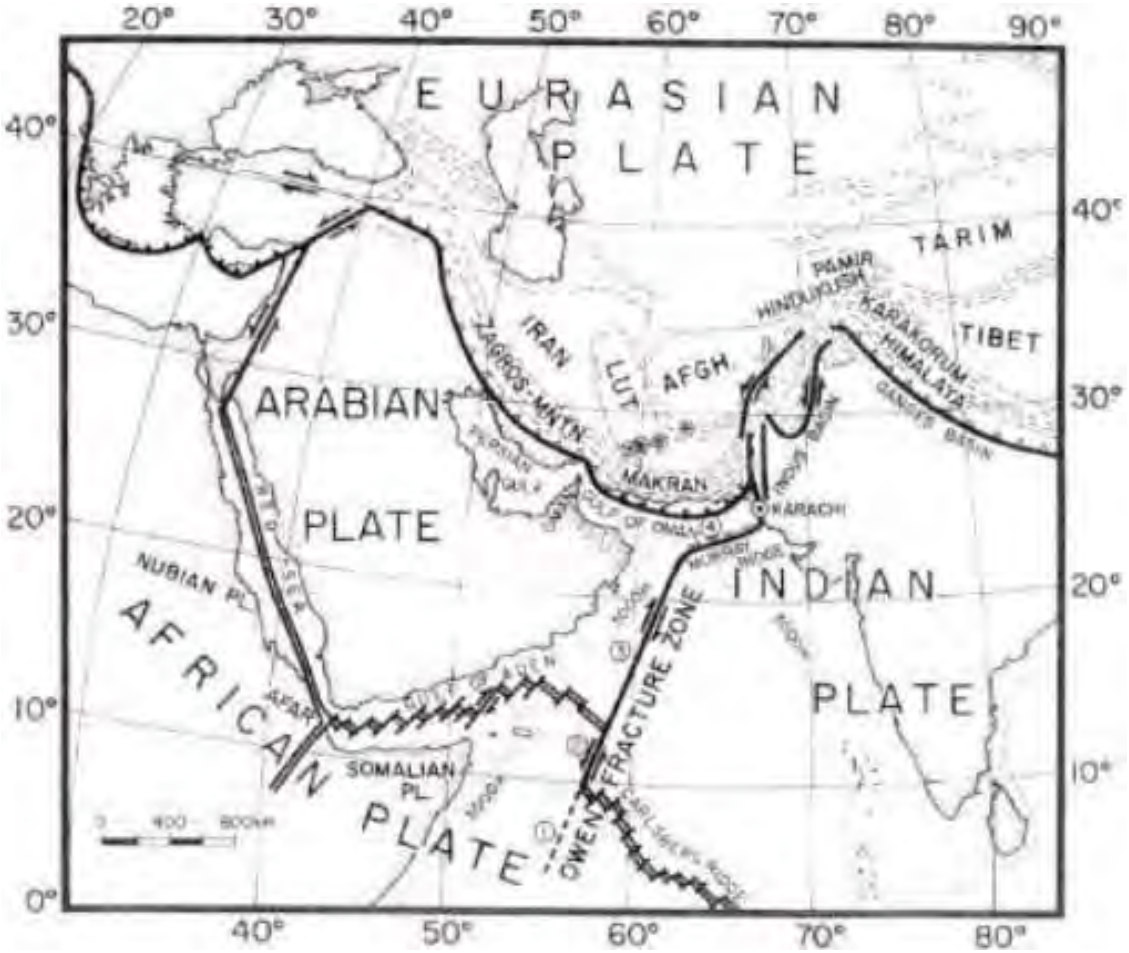


Figure 5.4: Plate-Tectonic Sketch Map

172. According to one classification, Pakistan has 15 seismo-tectonic regions. The proposed Project is in the seismo-tectonic region where a moderate level of seismic activity is believed to exist, but large magnitude earthquakes are rare. The Building Code of Pakistan places Karachi in Zone 2B (**Figure 5.5**). This corresponds to peak ground acceleration of 0.16g to 0.24g.

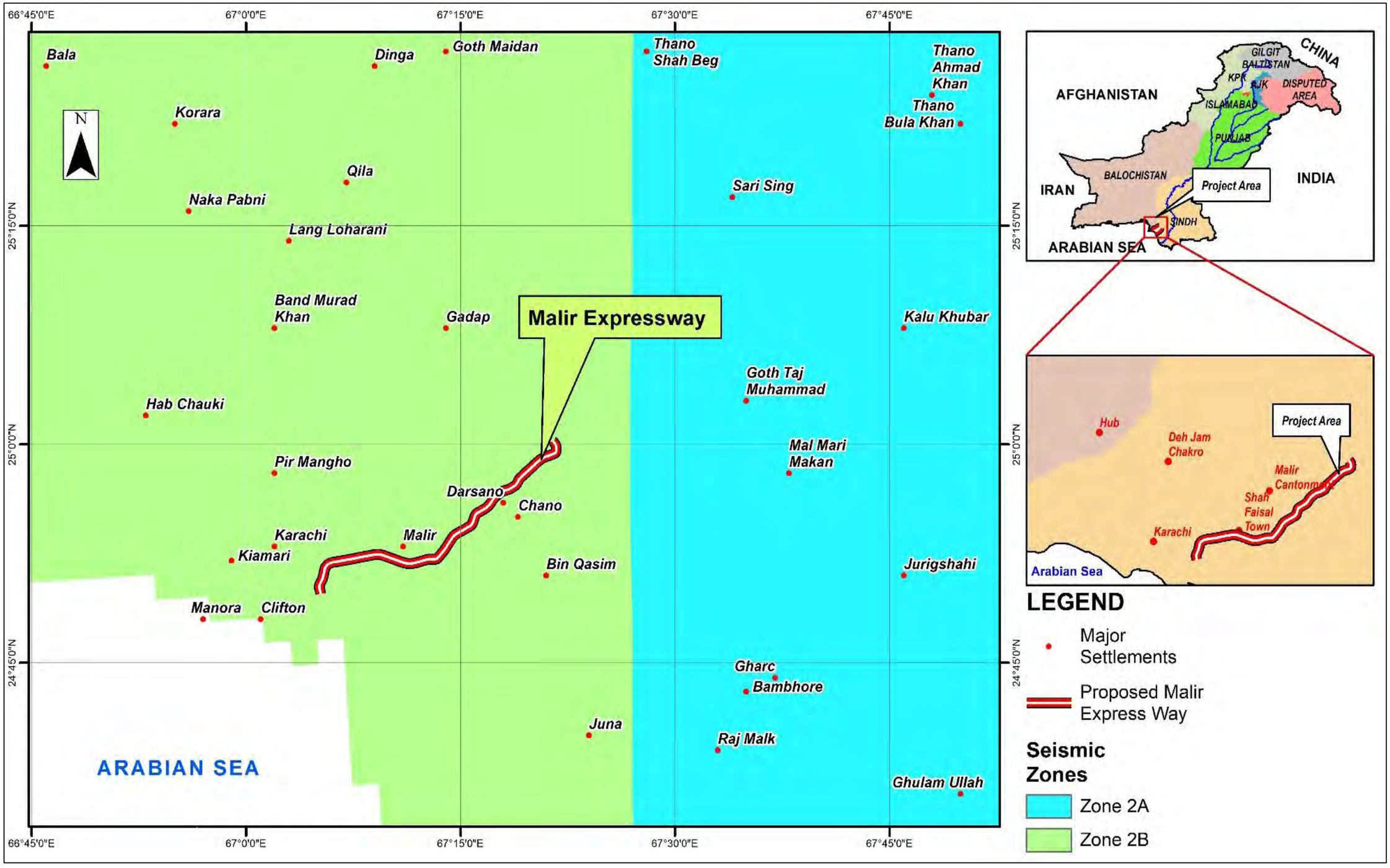


Figure 5.5: Project Area Seismic Map

5.4.4 Water Resources

173. The water supply of the Project Area is dependent on surface water and groundwater sources. Surface water sources include tributary of Malir River while groundwater source includes Dumlottee well-fields. However, the water supply from these wells is negligible, providing only 1.4 Million Gallon per day (MGD) of water after the rainy season while remaining dry for the rest of the year. Moreover, the quality of groundwater in most of the parts is saline due to over extraction and sea-water intrusion. Pakistan Council for Research in Water Resources (PCRWR) reports that 86 per cent of the water sources (surface water and groundwater) are contaminated with Coliform and are considered unsafe for drinking.

5.4.4.1 Surface Water

174. The Indus River, the main source of water for Karachi, is severely constrained by dry season demand, but has abundant wet season discharges. Except during the summer flood season, very little water escapes to the sea. Water from the Indus River is distributed over the Sindh Province through three barrage systems, namely, Guddu, Sukkur and Kotri. Urban and industrial water for Karachi is taken from the Kotri Barrage discharged through the Kalri Baghar Feeder Upper (KB Feeder Upper) to Kinjhar Lake. Kotri Barrage is the lowest barrage on the River Indus. Kinjhar Lake is a natural reservoir, the storage of which has been increased by constructing nearly 20 km of embankments having a maximum height of 9 m. The lake has a catchment area of 910 km^2. The supply from the River Indus comes via canals from Kinjhar, Haleji, Gharo and through conduits to the Dhabeji Pumping Station. The water is then distributed via conduits and distribution mains.

5.4.4.2 The Malir River Basin

175. The Malir River basin has a total catchment area of about 1,850 square kilometers around the southeastern boundary of Karachi. The Malir River system consists of two major streams, Mol and Khaddeji, and three tributaries named Konkar, Thaddo and Sukkan. River flows southwards and westwards through Gizri Creek and discharges finally into the Arabian Sea. The central part of the river basin is made-up of sediment deposits comprising coarse conglomerate, sandstone, clay stone and limestone, whereas the lower plain is composed of alluvial deposits, where the river is wider, shallower, and gets braided.

176. During the rainy season, The Malir River experiences flooding which is discussed in detail in the upcoming sections. Three (03) surface water samples were taken from Project Area to check the surface water quality which is discussed under **Section 5.4.10**.

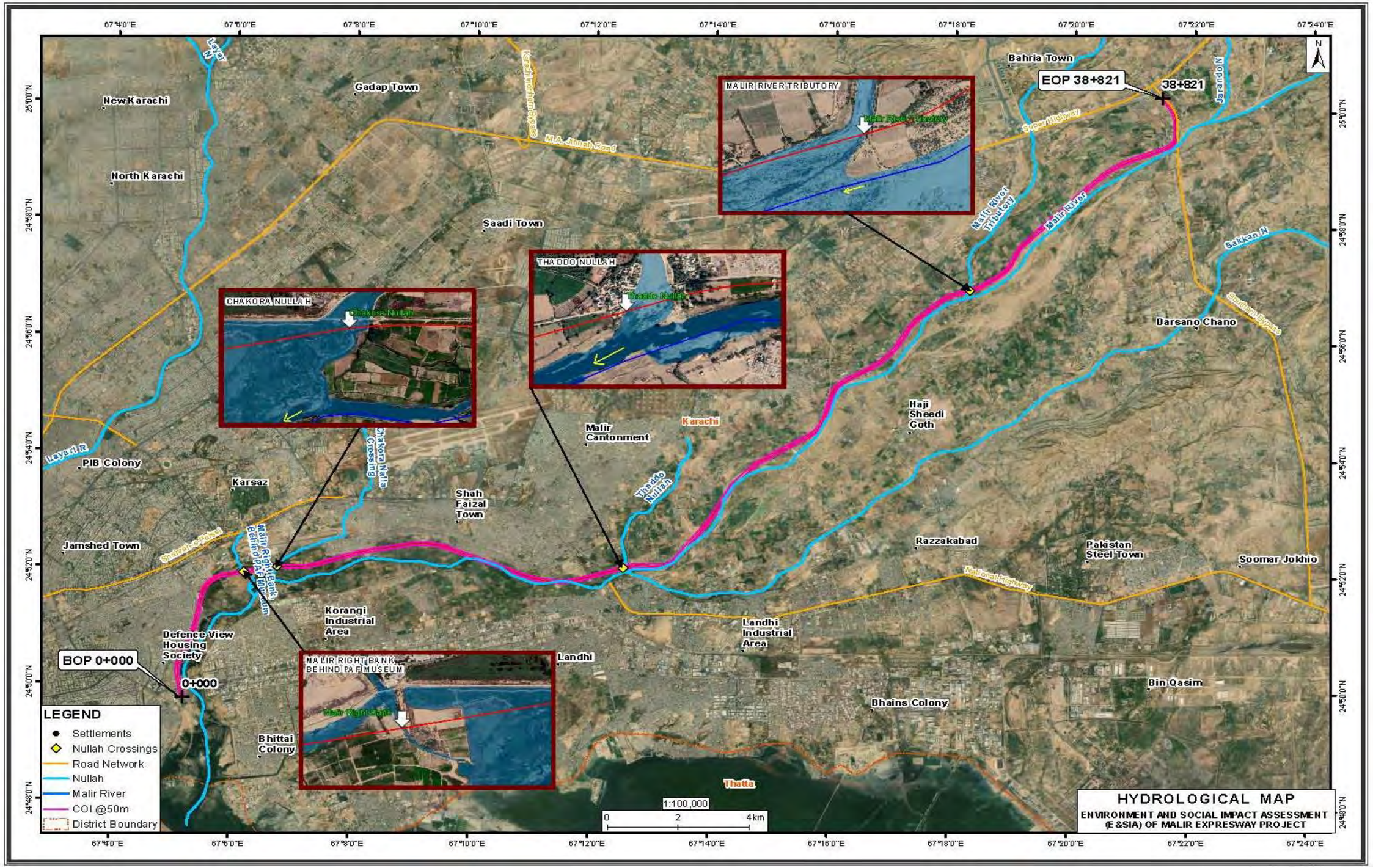


Figure 5.6: Surface Water Hydrological Map

5.4.5 Groundwater Resources

177. Ground water resources are limited in the Project Area, where small amounts of groundwater is extracted for private use. The groundwater aquifers at the start of proposed MEX i.e., close to the coastal belt are mostly saline and unusable for domestic purposes, where these aquifers are estimated to lie at depths of approximately 50-100 meters.

178. Dumlottee Well Field, located on the banks of Malir River in the Dumlottee Area about 30 km to the northeast of the city supplies water for a few months after the rainy season, whereas the system is almost dry the rest of the year. The water table along the route varies between 2 m to 23 m. The field investigations were carried out at four different locations to assess the ground water table as a part of geotechnical investigation study. The details are shown in **Table 5.1**.

Table 5.1: Position of Groundwater Table

Sr. No.	Boring No.	Chainage	Depth of Bore Hole	Depth of Water Table (m)	Location
1	Bore Hole-1	0+000	30	2.50	DHA Karachi Interchang-1
2	Bore Hole-2	9+000	39	12.20	Korangi Shah Faisal Interchang-2
3	Bore Hole-3	15+000	30	2.50	Malir Quaidabad Interchang-3
4	Bore Hole-4	25+000	30	23.00	Open (near Memon Goth)

179. Furthermore, two (02) groundwater/drinking water samples were taken from Project Area to check the quality of the groundwater / drinking water which are discussed in **Section 5.4.10**.

5.4.6 Water Supply System

180. Over the last three decades, Karachi consistently lagged in the maintenance and expansion of water supply system, bulk conveyance system, and distribution network as compared to the city's demands due to high population growth rate (4 to 5% per annum), low capacity of institutions, and low level of financing. The consequence is the rationing of water supply currently in practice in most of the areas of the city. Water is supplied only once in every two or three days and for the duration of two to three hours at a time. People are pushed to spend money on ground-level tanks, booster pumps, roof-top storage tanks and water filters and even then, all drinking water is boiled. Many households are compelled to use secondary sources of water such as shallow wells or tanker supplies just to meet their basic needs.

181. The water supply system of the Karachi Water and Sewerage Board (KWSB) supplies bulk water to the citizens of Karachi City from the Indus River, Hub Dam and Dumlottee Wells through the Greater Karachi Bulk Water Supply System, Karachi Water Supply

Canal and Dumlottee Conduit respectively, where about 33% of the total water supply is without filtration.

182. Of water that is filtered from filtration plants and reservoirs, water is supplied through the water trunk mains and distribution pipelines. The Water supply provided by Karachi Water and Sewerage Board (KWSB) is approximately 665 MGD against a demand of 820-1200 MGD resulting in a shortfall of 155-535 MGD. Unfortunately, an estimated 35 % (232 MGD) of the supplied water is also lost during transmission thus decreasing the water availability to a mere 433 MGD[6]. There is no metering for retail customers and only 25 % of commercial and industrial customers have a metered supply.

183. A total of 139 distribution pumping stations are being operated and managed by the KWSB. Some of the consumers install individual small suction pumps and suck water from distribution pipes forcibly.

5.4.7 Sewerage System

184. Four drainage systems are said to encompass Karachi City, the Lyari, the Malir, the Budnai and small streams referred to collectively as the coastal basin. The Malir River Basin and the Lyari River Basin contribute about 80% of the surface runoff from the city. Thus, the natural drainage system of Karachi City includes mainly the tributaries of the Malir and Lyari Rivers. While these are perennial streams, in stream flow is intermittent, and freshwater inflow depends on rainfall and runoff; both rivers also intercept discharges from sewer lines and outfalls and carry sewage to the sea from all parts of the city.

185. Drainage channels collect surface runoff through hundreds of small/large side channels and lined nullahs (drains) that serve as important components of the drainage network. These are generally dry built channels and streambeds that flow into the main rivers described above.

186. The existing coverage of the sewerage system is only about 30% for the Karachi metropolitan area. The existing sewerage system also has several problems, which include low sewage flows received at existing sewage treatment plants, resulting from the inadequate provisions of sewer trunk mains and the malfunctioning of pumping facilities, resulting in the deterioration of water quality in rivers and canals, and clogging of waterways caused by damping of massive rubbish.

5.4.8 Flooding

187. The Climate of Karachi is semi-arid and rainfall is low, highly variable, and an unreliable source of water. Previously, there have been four damaging floods in Karachi in the past 50 years; 1967, 1973, 1977, 1978, and 2020. The most devastating flood in the history

[6] *Situational Analysis of Water Resources of Karachi, 2019, WWF Report Under the EU Funded Project*

occurred in July 2020, where more rain befell the city of Karachi then it ever had in the history of the city, following flash flooding in all areas of the city resulting in damage of tremendous life and property loss.

188. The maximum flow in Malir River at this location had been estimated between 200,000 to 250,000 cusecs.

Malir River Floodplain

189. The Malir River is one of the primary rivers that has caused massive destruction to Karachi during the monsoon seasons. Due to low laying surrounding areas flood protection structures become necessary and thus embankment bunds were constructed at both left bank as well as right bank.

190. The hydraulic calculation was done in January 2021[7] for the section at Super Highway and the sections downstream from it. Based on the hydrologic studies carried out, following hydrologic parameters were calculated:

191. For 50-year return period

(i)	Return period for the estimation of storm water flows	50-Year
(ii)	24-hour rainfall at Karachi for 50-year return period	181 mm
(iii)	Estimated storm water flow at Outfall of Malir River	163,647 cusecs

192. For 100-year return period

(i)	Return period for the estimation of storm water flows	100-Year
(ii)	24-hour rainfall at Karachi for 100-year return period	198 mm
(iii)	Estimated storm water flow at Outfall of Malir River	182,770 cusecs

193. This report recommends that proposed alignment is feasible and suggested height of embankment up 06 meters from the bed of Malir River for 50, 100-year return period. The detailed hydrological & hydraulic analysis study is attached in the **Annex-IV**.

5.4.9 Climate

194. The coastal meteorology and hydrography of Project Area is controlled by the seasonal change in the north Arabian Sea i.e., monsoonal system. The proposed Project Area is located just above the tropical zone on the coast of the Arabian Sea at 24º45" to 25º15" north, and 66º37" to 67º37" east at about 20 m above sea level (Karachi airport weather station). The climate of the proposed Project Area can be characterized by dry, hot, and humid conditions and in general terms it is moderate, sunny, and humid. There is a minor seasonal intervention of a mild winter from mid-December to mid- February followed by a long hot and humid summer extending from April to September, with monsoon rains from July to mid- September. The level of precipitation is low for most of the year. The

[7] *Hydrology & Hydraulic Analysis for Malir Expressway*

Project Area also receives the monsoon rains from July to September. The humidity levels usually remain high from March to November, while very low in winter as the wind direction in winter is North Easterly. The description of various climatic parameters in the Project Area is as follows:

5.4.9.1 Climate Vulnerability

195. Karachi city has an arid climate with low rainfall which is highly variable, with torrential rain taking place from time to time, leading to an intensification of the surface runoff. This is because the rate of water percolation into soil is lesser than the amount of rainwater falling on the surface. Heavy showers take place in the city either because of tropical storms usually in June, which rarely affect coastal areas but bring heavy showers for short periods and cause flooding.

196. The heavy monsoon rain mostly occurs in July and August and is the main cause of flooding in the city. However, its re-occurrence is estimated at about 3 to 5[8] year intervals. Flood affected areas of the city and areas susceptible to flooding include the old city areas such as Kharadar, Mithadar, Bunder Road, Ram-swami and Arambagh.

197. In July-2020[9], the weather system brought heavy rains in Karachi. According to data provided by the MET Office, the highest rainfall was recorded in Gulistan-e-Johar, at 66 millimeters (mm), while 55 mm was registered at Old Airport, 55 mm in Pehlwan Goth, 42 mm in Malir, Saddar 43 millimeters (mm), while 26 mm was registered at Pakistan Air Force (PAF) Faisal Base, 22mm in Nazimabad, 12mm at PAF Masroor Base, 8.8mm at Karachi's Jinnah International Airport, 3.1mm in Landhi, and 1.2mm in Surjani Town.

198. According to the Pakistan Meteorological Department (PMD), the city received more than 80 mm rainfall in the third spell of the monsoon of 2020. The heavy to moderate rainfall caused flooding in low lying areas of the city and inundated several key roads, causing problems for the commuters.

5.4.9.2 Temperature

199. **Table 5.2** and **Figure 5.7** show the maximum, minimum and average monthly temperatures of the Project Area for the recent years (2016-2019). The maximum temperature range is 24 – 37 °C. The average temperature range is 21 - 34 °C. The minimum monthly temperature range is 17– 30 °C. April to November are the hot months whereas cold months are December to March.

[8] *Mott Macdonald Pakistan, (2018), EIA study for Karachi BRT – Red Line*
[9] *Rapid Need Assessment Urban Flooding Karachi July 2020, Monitoring Evaluation & Research Program by HANDS*

Table 5.2: Maximum, Minimum and Average Temperature °C (Karachi Airport)

Year	Month's Temperature °C											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016												
Max	26	29	32	34	35	36	33	33	32	33	32	29
Avg	22	24	27	29	31	31	30	30	28	28	27	24
Min	19	20	24	25	28	28	29	28	26	25	23	21
2017												
Max	25	29	32	35	37	35	32	32	32	34	30	27
Avg	21	24	27	30	32	32	30	29	29	30	26	23
Min	18	21	23	26	28	29	28	27	27	27	23	20
2018												
Max	26	28	31	35	37	34	32	30	30	35	34	29
Avg	22	24	27	30	33	31	30	28	27	33	32	26
Min	19	21	24	26	29	29	28	27	26	30	28	23
2019												
Max	27	27	30	34	35	36	33	31	32	34	30	27
Avg	25	24	28	32	33	34	31	30	31	32	28	24
Min	21	20	23	27	28	29	28	27	27	28	24	20
2020												
Max	24	30	30	34	35	-	-	-	-	-	-	-
Avg	21	27	27	32	33	-	-	-	-	-	-	-
Min	17	21	21	25	27	-	-	-	-	-	-	-

Source: Extract from Temperature Graph (World Weather Online)

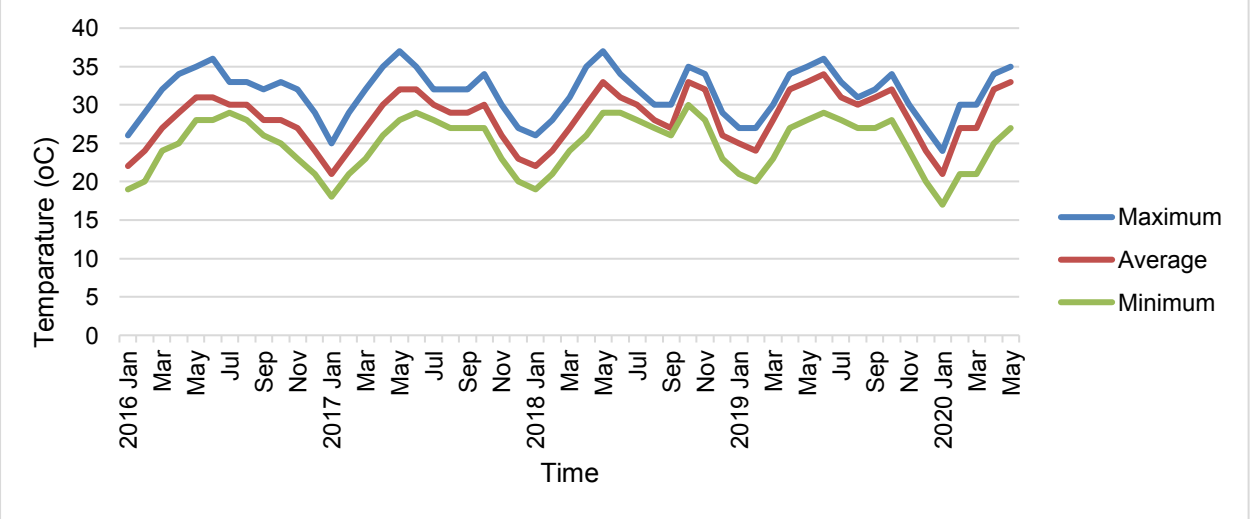


Figure 5.7: Maximum, Minimum and Average Temperature (Karachi)

5.4.9.3 Heat Wave (Climate Change Impact)

200. In 2015, Karachi also experienced the deadliest heat wave in the history of the city in over 50 years. The city witnessed sweltering heat that continued for more than five days and in its wake left over 1,200 people dead and 40,000 suffering from heatstroke and heat exhaustion. On the heat index scale, which is a good explanatory concept utilized

to gauge the impact of heat-wave phenomenon to a person in a particular area by combining the overall impacts of temperature, air pressure, humidity and wind speed, in Karachi, during this event, the maximum temperature recorded was 44.8°C but the heat index was around 66°C on the peak heat wave day i.e. 20th June 2015 because of low air pressure and wind speed and very high humidity.[10]

5.4.9.4 Rainfall

201. Mean monthly rainfall data and the number of rainy days recorded at the Airport Weather Station, Karachi in the vicinity of the Project Area is given in **Table 5.3**. The minimum average monthly rainfall of the Project Area varies from 0 to 0.8 mm whereas maximum average monthly rainfall varies from 14.31 mm to 118.90 mm. As this region falls in the semi-arid climatic zone, the rainfall in Karachi is extremely low and erratic.

202. The maximum rainfall occurs during the months of July and August. Winter rains generally occur during the months of December to March, whereas, May, October, November is normally the months with least precipitation.

Table 5.3: Average Rainfall (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	0.0	0.0	0.0	0.0	0.0	10.6	73.6	16.2	N/A	0.0	0.0	0.0	33.46
2002	0.0	2.4	0.0	0.0	0.0	N/A	N/A	52.2	N/A	0.0	0.5	0.4	13.87
2003	6.4	21.8	0.0	0.0	0.0	16.3	270.4	9.8	N/A	0.0	0.2	0.0	54.15
2004	13.7	0.0	0.0	0.0	0.0	N/A	3.0	5.6	N/A	39.3	0.0	4.3	13.18
2005	6.6	12.8	N/A	0.0	0.0	N/A	N/A	0.3	54.9	0.0	0.0	17.1	18.34
2006	N/A	0.0	N/A	0.0	0.0	0.0	66.2	148.6	21.9	0.0	3.1	61.3	60.22
2007	0.0	13.2	33.4	0.0	0.0	110.2	N/A	N/A	N/A	N/A	N/A	N/A	52.26
2008	8.0	Trace	1.1	0.0	0.0	0.0	54.0	37.5	Trace	0.0	0.0	21.0	24.32
2009	3.0	Trace	0.0	Trace	0.0	2.6	159.9	44.0	68.9	0.0	0.0	1.5	55.68
2012	0.2	0.0	0.0	0.0	0.0	Trace	Trace	8.1	121.0	0.0	0.0	22.8	152.1
2013	Trace	20.0	2.8	30.0	0.0	Trace	5.5	105.4	4.0	1.2	0.0	0.0	168.9
2014	Trace	0.0	12.4	0.0	1.3	Trace	1.1	9.9	1.4	0.0	4.6	0.0	30.7
2015	0.3	2.1	2.8	0.0	0.0	Trace	46.6	1.4	Trace	0.0	0.0	0.0	53.2
2016	3.1	0.0	Trace	0.0	0.0	65.8	1.9	96.9	Trace	0.0	0.0	0.0	167.7
2017	41.5	Trace	0.0	0.0	0.0	58.8	33.3	65.6	26.4	0.0	0.0	6.6	232.2
2018	Trace	Trace	0.0	0.0	0.0	Trace	Trace	0.8	Trace	0.0	0.0	Trace	0.8
2019	39.4	Trace	2.2	0.0	0.0	1.6	66.3	204	51.7	1.2	Trace	Trace	367.3
2020	Trace	2.6	0.5	0.0	0.0	Trace	101.2	366.8	Trace	0.0	3.1	0.0	474.2

Source: Pakistan Meteorological Department

[10] Technical Report on Karachi Heat wave June 2015, Ministry of Climate Change, Government of Pakistan.

5.4.9.5 Relative Humidity

203. The relative humidity data at met station (Karachi Airport) around the proposed Project Area is given in **Table 5.4**. Relative humidity levels are mostly high during the month of July and August, whereas these are lower during December.

Table 5.4: Average Humidity (%)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2014	25.0	27.0	35.0	47.0	57.0	61.0	64.0	61.0	60.0	36.0	36.0	31.0	45.0
2015	38.0	41.0	37.0	45.0	60.0	56.0	69.0	67.0	56.0	47.0	28.0	31.0	47.9
2016	46.0	25.0	41.0	47.0	60.0	60.0	68.0	70.0	63.0	57.0	34.0	38.0	50.8
2017	38.0	25.0	36.0	44.0	59.0	62.0	70.0	67.0	63.0	44.0	29.0	20.0	46.4
2018	36.0	37.0	33.0	45.0	46.0	65.0	65.0	68.0	63.0	40.0	32.0	30.0	46.7
2019	40.4	33.9	36.6	48.0	55.6	58.8	64.8	72.6	67.6	41.1	34.6	29.7	48.6
2020	29.9	28.1	34.2	44.4	57.1	56.8	65.0	74.8	62.4	38.1	32.9	29.1	46.1
Source: Pakistan Meteorological Department													

5.4.9.6 Wind Speed

204. The mean monthly wind speed at Airport, met station around proposed Project Area is given in **Table 5.5**. The data reveals that the wind speeds are generally lower during winter (December to March) while higher wind speeds are recorded during summer (May, June, July).

Table 5.5: Maximum and Average Wind Speed (kmph)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	2.6	3.4	4.3	5.6	7.5	8.1	6.8	7.3	5.5	3.7	2.0	2.4	4.9
2002	3.6	3.9	4.0	6.5	8.5	8.2	9.8	7.3	7.7	3.3	2.9	3.2	5.7
2003	4.0	5.0	5.4	5.2	7.7	8.8	6.7	7.1	6.0	3.2	3.1	3.0	5.4
2004	3.4	3.7	4.0	6.0	8.0	9.0	10.0	9.5	7.3	3.8	1.0	2.5	5.7
2005	3.6	4.2	4.8	5.1	7.1	7.5	9.0	6.9	6.4	3.9	2.0	1.5	5.2
2006	2.0	3.0	3.0	6.2	8.0	7.7	8.3	6.2	4.7	4.2	2.2	3.0	4.9
2007	2.0	3.7	4.0	4.0	6.0	6.3	N/A	N/A	N/A	N/A	N/A	N/A	4.3
2008	4.3	7.6	8.2	10.5	12.6	7.6	11.0	9.3	8.7	6.6	5.1	3.9	7.9
2009	7.0	7.2	7.9	9.3	9.8	9.7	9.5	9.3	9.1	6.1	5.0	3.9	7.8
2012	5.8	6.6	9.3	9.8	12.3	12.8	13.1	11.2	8.4	7.1	5.7	5.8	9.0
2013	5.2	6.9	9.0	10.3	11.5	10.8	12.0	11.2	10.3	7.7	5.1	4.5	8.7
2014	5.9	8.9	8.6	11.5	12.4	13.4	12.8	11.6	11.7	8.3	6.0	4.5	9.6
2015	6.9	10.3	10.1	11.5	12.8	12.3	13.7	12.3	10.5	8.7	5.6	5.8	10.0
2016	7.5	8.7	4.8	1.1	13.0	11.7	11.8	10.5	12.1	9.2	5.5	5.2	8.4
2017	7.0	8.0	10.8	12.1	12.8	11.5	12.1	10.3	8.7	8.5	5.4	7.4	6.9
2018	6.3	7.0	9.5	10.2	10.8	11.1	12.3	12.4	12.2	8.7	6.1	6.8	9.4
2019	6.7	8.9	10.2	11.7	12.1	11.7	13.7	9.1	8.5	8.0	6.9	7.4	9.6
2020	9.0	9.4	9.0	10.5	13.3	10.9	10.1	8.9	9.4	7.3	6.2	5.5	9.1
Source: Pakistan Meteorological Department													

5.4.9.7 Cyclones

205. The Arabian Sea is known to be frequented by general cyclonic storms, resulting in huge losses to life and property in the coastal areas. A significant number of the cyclonic storms produced in the Arabian Sea move towards north and northeast and some of them land in Pakistan. However, most of these cyclones which tend to move towards southern part of the Pakistan coast very often reciprocate towards eastern coast of India. Coastal Sindh is more vulnerable than the west coast of Pakistan to storm surges, associated with the severe cyclonic storms generated in the adjoining Arabian Sea.

206. The available data on cyclones and storms reveals that the Pakistan coast is vulnerable mostly during the period from April through June while no storm has ever been observed during January to March (news report). Tropical cyclones squander between Gulf of Cambay and Karachi. The size of the tropical cyclones is generally 270 -720 Km with an average speed of 7 to 18 Km/hr.

5.4.10 Environmental Monitoring and Sampling and Testing

207. To determine the existing ambient air, noise, water, and wastewater quality of the area following locations were selected in the CoI. The sampling locations for the environmental monitoring of ambient air, noise and water for proposed bypass Project are shown in **Figure 5.11** respectively. These monitoring locations has been finalized considering the sensitive receptors along the corridor.

208. Following criteria was considered for the selection of environmental monitoring and sampling locations along the road alignment:

- Major surface water bodies e.g. canals, river, distributaries, riverine area, nullahs, and nearby water ponds within the CoI were considered for selection of surface water sampling locations; and
- Ambient air and noise (above ground) monitoring points are selected based on the Source-Receptor Approach. The sources include traffic, construction activities and construction camps whereas the receptors comprise educational, health, religious, cultural, archeological, ecological resources, etc. along the Project alignment.

209. Total three (03) surface water samples and two (02) drinking water samples were collected. Similarly, five (05) points were selected for ambient air, noise and vibration monitoring at site. The summary of ambient air, noise, surface, and ground water analysis results are shown in **Table 5.6** below

Table 5.6: Environmental Monitoring, Sampling and Testing Points

Sr. No.	RD Stretch	District	Surface Water / Wastewater	Drinking Water / Ground Water	Ambient Air, Noise and Vibration Monitoring	Remarks
1.	0+300	Korangi	SW/WW1	----	----	All parameters are within SEQS except Chloride due to saline nature of strata.
2.	0+300	Korangi	---	---	AN1	All parameters of AA-01 and NL-01 are within SEQS limits.
3.	7+600	Korangi	---	---	AN2	All parameters of AA-02 and NL-02 are within SEQS limits.
4.	15+250	Korangi	---	---	AN3	All parameters of AA-03 are with SEQS limits except NO_2 due to Diesel train commute at set quick intervals as well as public transport and heavy traffic movement. NL-03 is also within SEQS limits.
5.	16+900	Malir	---	DW/GW1	---	All parameters are within SEQS except TDS, Total Hardness and Chloride, due to saline nature of strata.
6.	19+500	Malir	SW/WW2	---	---	All parameters are within SEQS Limits.
7.	23+750	Malir	---	---	AN4	All parameters of AA-04 and NL-04 are within SEQS limits.
8.	32+700	Malir	---	DW/GW2	---	All parameters are within SEQS limits however, Coliform and E. Coli was detected (due to biological contamination in Malir Nullah).
9.	37+100	Malir	SW/WW3	---	---	All parameters are within SEQS limits.
10.	37+150	Malir	---	---	AN5	All parameters of AA-05 and NL-05 are within SEQS limits.
Total			**03**	**02**	**05**	

210. The summary of ambient air, noise, surface, and ground water analysis are shown in below Tables. The details are attached in environmental monitoring report as **Annex-VIII**.

Ambient Air

211. Ambient air quality data for SO_2, NO, NO_2, CO_2, VOC, PM_{10} and $PM_{2.5}$ was monitored at five (05) points (**Figure 5.11**). The results were compared with the SEQS standards and guidelines for ambient air. The summary of ambient air monitoring points along with averaging periods are provided in **Table 5.7**. The results reveal that the PM_{10} and $PM_{2.5}$ are exceeding the stringent limits in some areas.

Table 5.7: Ambient Air Monitoring Results

Sr. No.	Monitoring Points	Pollutants									
		CO ug/m³	NO ug/m³	NO_2 ug/m³	SO_2 ug/m³	VOC ppm	PM_{10} ug/m³	$PM_{2.5}$ ug/m³	O_3 µg/m³	SPM ug/m³	Lead µg/Nm³
		8 Hr	24 Hr	24 Hr	24 Hr	24 Hr	24 Hr	24 Hr	1 Hr	24 Hr	24 Hr
1	AA-01	0.69	14.3	30.47	7.98	ND	55.87	36.67	23.4	244.62	0.21
2	AA-02	0.625	14.48	27.43	8.31	ND	65.87	58.92	21.29	294.37	0.59
3	AA-03	4.69	18.75	**119.85**	7.87	ND	72.62	65.29	20.98	349	0.58
4	AA-04	0.86	13.62	20.49	10.81	ND	62.67	56.21	22.7	282.17	0.25
5	AA-05	1.19	14.14	21.33	7.1	ND	45.6	39.6	21.6	269.7	0.32
	SEQS	**5**	**40**	**80**	**120**	**NS**	**150**	**35**	**130**	**500**	**1.5**

Background Noise Levels

212. The background noise level monitoring was carried out at five (05) locations as shown in **Figure 5.11**. The results were compared with the SEQS for noise Commercial area (B) with limiting value of 65 dB(A) - day time, 55 dB(A) - night time and Residential area (A) with limiting value of 55 dB(A) - day time, 45 dB(A) - night time where applicable. The summary of background noise monitoring points along with averaging period are provided in **Table 5.8**.

Table 5.8: Noise Level Monitoring Results

Sr. No.	Measurement Points	Duration		Comparison Values (SEQS)	Noise Level in dB(A) Leq	Remarks
1.	NL-01	24 Hours	– Day Time	B = 65 dB(A)	46.74	Within SEQS Limits
			– Night Time	B = 55 dB(A)	40.3	Within SEQS Limits
2.	NL-02	24 Hours	– Day Time	A = 55 dB(A)	48.08	Within SEQS Limits
			– Night Time	A = 45 dB(A)	44.91	Close to SEQS Limits
3.	NL-03	24 Hours	– Day Time	B = 65 dB(A)	52.35	Within SEQS Limits
			– Night Time	B = 55 dB(A)	51.69	Within SEQS Limits
4.	NL-04	24 Hours	– Day Time	A = 55 dB(A)	47.58	Within SEQS Limits
			– Night Time	A = 45 dB(A)	**46.65**	Above SEQS Limits due to temporary non-point source (small generators nearby).
5.	NL-05	24 Hours	– Day Time	B = 65 dB(A)	49.42	Within SEQS Limits
			– Night Time	B = 55 dB(A)	47.75	Within SEQS Limits

Day Time hour: 06:00am to 10:00pm *Night Time hour: 10:00pm to 06:00am*
A = Residential Area Noise *B = Commercial Area Noise*

Surface Water

213. To document the existing quality of surface water, three (03) grab samples of surface water/wastewater were collected. All the samples were collected as grab samples and after being labeled and preserved, they were transported to the laboratory for testing. Location of all the sampling points is given in **Figure 5.11**. The results were compared with the SEQS for surface water which are shown in **Table 5.9**.

Table 5.9: Surface Water/Wastewater Sampling Results

Sr. No.	Parameter	Units	SW-01	SW-02	SW-03	SEQS
1	Temperature	◦C	21	22	16	40 + ≤ 03
2	pH @ 25 ˚C	pH	7.72	7.61	7.5	6 to 9
3	Biological Oxygen Demand (BOD5)	(mg/L)	28	16	30	80
4	Chemical Oxygen Demand	(mg/L)	102	47	96	150
5	Total Dissolved Solids	(mg/L)	3055	250	1705	3500
6	Total Suspended Solids	(mg/L)	38	32	52	200
7	Oil & Grease	(mg/L)	6	<5	<5	10
8	Chloride	(mg/L)	1316.21	64.52	641.97	1000
9	Phenolic compound	(mg/L)	<0.1	<0.1	<0.1	0.1
10	Fluoride	(mg/L)	1.34	0.78	1.38	10
11	Anionic Detergent	(mg/L)	0.02	0.01	0.12	20
12	Selenium	(mg/L)	BDL	BDL	ND	0.5
13	Sulphide	(mg/L)	0.04	<0.04	0.06	1.0
14	Ammonia	(mg/L)	1.38	2.04	2.01	40
15	Cadmium	(mg/L)	ND	ND	ND	0.1
16	Chromium	(mg/L)	0.008	<0.005	0.009	1.0
17	Copper	(mg/L)	<0.05	<0.05	<0.05	1.0
18	Lead	(mg/L)	ND	ND	ND	0.5
19	Mercury	(mg/L)	ND	ND	ND	0.01
20	Nickel	(mg/L)	ND	ND	ND	1.0
21	Silver	(mg/L)	ND	ND	ND	1.0
22	Zinc	(mg/L)	0.09	0.04	0.06	5.0
23	Total Iron	(mg/L)	0.61	0.36	0.12	8.0
24	Manganese	mg/L)	<0.01	0.01	<0.01	1.5
25	Boron	(mg/L)	0.2	<0.1	0.2	6.0
26	Sulphate	(mg/L)	298	22.2	0.52	600
27	Arsenic	(mg/L)	ND	ND	ND	1.0
28	Chlorine	(mg/L)	0.93	0.91	0.12	1.0
29	Total Toxic Metals	(mg/L)	<2	<2	<2	2.0
30	Barium	(mg/L)	0.11	ND	0.07	1.5
31	Cyanide	(mg/L)	ND	ND	ND	1.0

NS: Not Specified *ND: Not Detected*

Groundwater / Drinking Water

214. To document the existing groundwater quality, two (02) samples were collected. All the samples were collected as grab samples and after being labeled and preserved, they were transported to the laboratory for testing. These samples were tested against all parameters. Location of all the sampling points is given in **Figure 5.11**. Results of these samples along with the respective SEQS values are shown in **Table 5.10**.

Table 5.10: Groundwater / Drinking Water Sampling Results

Sr. No.	Parameter	Units	GW 01	GW 02	SEQS
1	pH @ 25 ˚C	pH	6.81	6.79	6.5-8.5
2	Total Dissolved Solids	(mg/L)	1415	310	<1000
3	Phenolic compound	(mg/L)	BDL	BDL	0.002
4	Chloride	(mg/L)	477.49	48.39	<250
5	Total Hardness as CaCO3	(mg/L)	741.2	183.12	<500
6	Aluminum	(mg/L)	<0	<0.01	0.2
7	Residual Chlorine	(mg/L)	<0.1	<0.1	0.2-0.5
8	Antimony	(mg/L)	ND	ND	<0.005
9	Arsenic	(mg/L)	ND	ND	0.05
10	Taste	…..	Non-Objectionable	Non-Objectionable	Non-Objectionable
11	Odor	…..	Non-Objectionable	Non-Objectionable	Non-Objectionable
12	Barium	(mg/L)	0.09	ND	0.7
13	Boron	(mg/L)	0.1	<0.1	0.3
14	Copper	(mg/L)	<0.05	<0.05	2.0
15	Lead	(mg/L)	ND	ND	<0.05
16	Mercury	(mg/L)	ND	ND	<0.001
17	Nickel	(mg/L)	ND	ND	<0.02
18	Manganese	(mg/L)	<0.01	ND	0.5
19	Zinc	(mg/L)	0.06	0.06	<5
20	Selenium	(mg/L)	BDL	BDL	0.01
21	Cyanide	(mg/L)	ND	ND	0.05
22	Chromium	(mg/L)	0.005	ND	<0.05
23	Fluoride	(mg/L)	1.01	0.8	1.5
24	Cadmium	(mg/L)	ND	ND	0.01
25	Nitrate	(mg/L)	BDL	BDL	0.5
26	Nitrite	(mg/L)	BDL	BDL	3
27	Color	TCU	4	2	<15TCU
28	Turbidity	NTU	<5	<5	<5
29	Total Coliform	count/100ml	ND	32	0/100ml
30	Escherichia Coli	count/100ml	ND	10	0/100ml
31	Pesticides	mg/L	ND	ND	0.15
32	Chromium	(mg/L)	0.005	ND	<0.05

Sr. No.	Parameter	Units	GW 01	GW 02	SEQS
33	Fluoride	(mg/L)	1.01	0.8	1.5
34	Cadmium	(mg/L)	ND	ND	0.01

NS: Not Specified ND: Not Detected

215. The details are attached in environmental monitoring report as **Annex-VIII** and pictures are shown in the **Photolog**.

5.4.11 Land use of the Proposed Project

216. There are different classes of land use i.e., barren, agricultural, built-up, vegetative cover, meadow, water bodies, railway lines, roads, graveyard, and uncultivable land. Land use of the proposed Project based on the GIS land use map in the CoI and RoW is given in **Table 5.11** whereas land use maps of the proposed Project is presented as **Figure 5.12**.

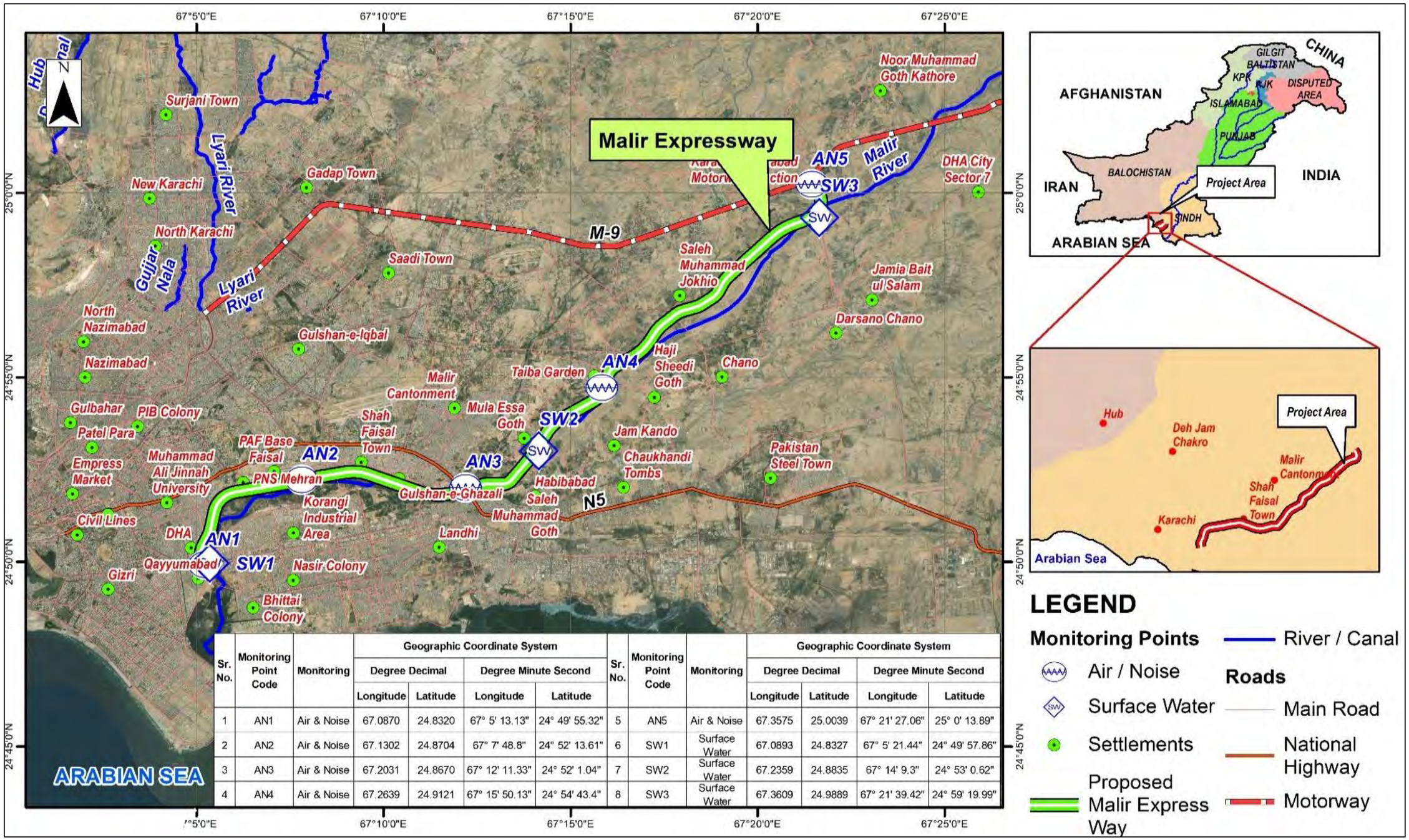
Table 5.11: Summary of Land use in the RoW*

Sr. No.	Class Name	RoW- Area (Acres)
1	Barren / Open Area	526.88
2	Built up Area	57.70
3	Cultivated Land	225
4	Flyover	0.47
5	Graveyard	4.57
6	Orchard	0.90
7	Road / Track	43.28
8	Stream / Nullah	55.29
9	Trees / Bushes	17.37
10	Water Pond	2.61
Total		**1006.00**

*Based on initial surveys carried out for report, figures will be finalized once Board of Revenue carries out their survey and finalizes Section IV of Land Acquisition Act. Further details will be provided in Land Acquisition and Resettlement Plan that will be prepared.

5.4.12 Sensitive Receptors

217. For the proposed Project, the sensitive receptors include, but are not limited to the educational, health, religious, cultural, archeological, and ecological resources in the CoI. These are the areas where the occupants are more susceptible to the adverse effects of exposure to toxic chemicals and other pollutants through air and noise emissions due to construction and O&M activities within the defined CoI. A comprehensive map showing environmentally sensitive receptors of the Project Area such as, schools, mosques, graves, Shrine, BHU, etc. is given in **Figure 5.13**.



Sr. No.	Monitoring Point Code	Monitoring	Geographic Coordinate System				Sr. No.	Monitoring Point Code	Monitoring	Geographic Coordinate System			
			Degree Decimal		Degree Minute Second					Degree Decimal		Degree Minute Second	
			Longitude	Latitude	Longitude	Latitude				Longitude	Latitude	Longitude	Latitude
1	AN1	Air & Noise	67.0870	24.8320	67° 5' 13.13"	24° 49' 55.32"	5	AN5	Air & Noise	67.3575	25.0039	67° 21' 27.06"	25° 0' 13.89"
2	AN2	Air & Noise	67.1302	24.8704	67° 7' 48.8"	24° 52' 13.61"	6	SW1	Surface Water	67.0893	24.8327	67° 5' 21.44"	24° 49' 57.86"
3	AN3	Air & Noise	67.2031	24.8670	67° 12' 11.33"	24° 52' 1.04"	7	SW2	Surface Water	67.2359	24.8835	67° 14' 9.3"	24° 53' 0.62"
4	AN4	Air & Noise	67.2639	24.9121	67° 15' 50.13"	24° 54' 43.4"	8	SW3	Surface Water	67.3609	24.9889	67° 21' 39.42"	24° 59' 19.99"

Figure 5.8: Environmental Monitoring and Sampling Location Map

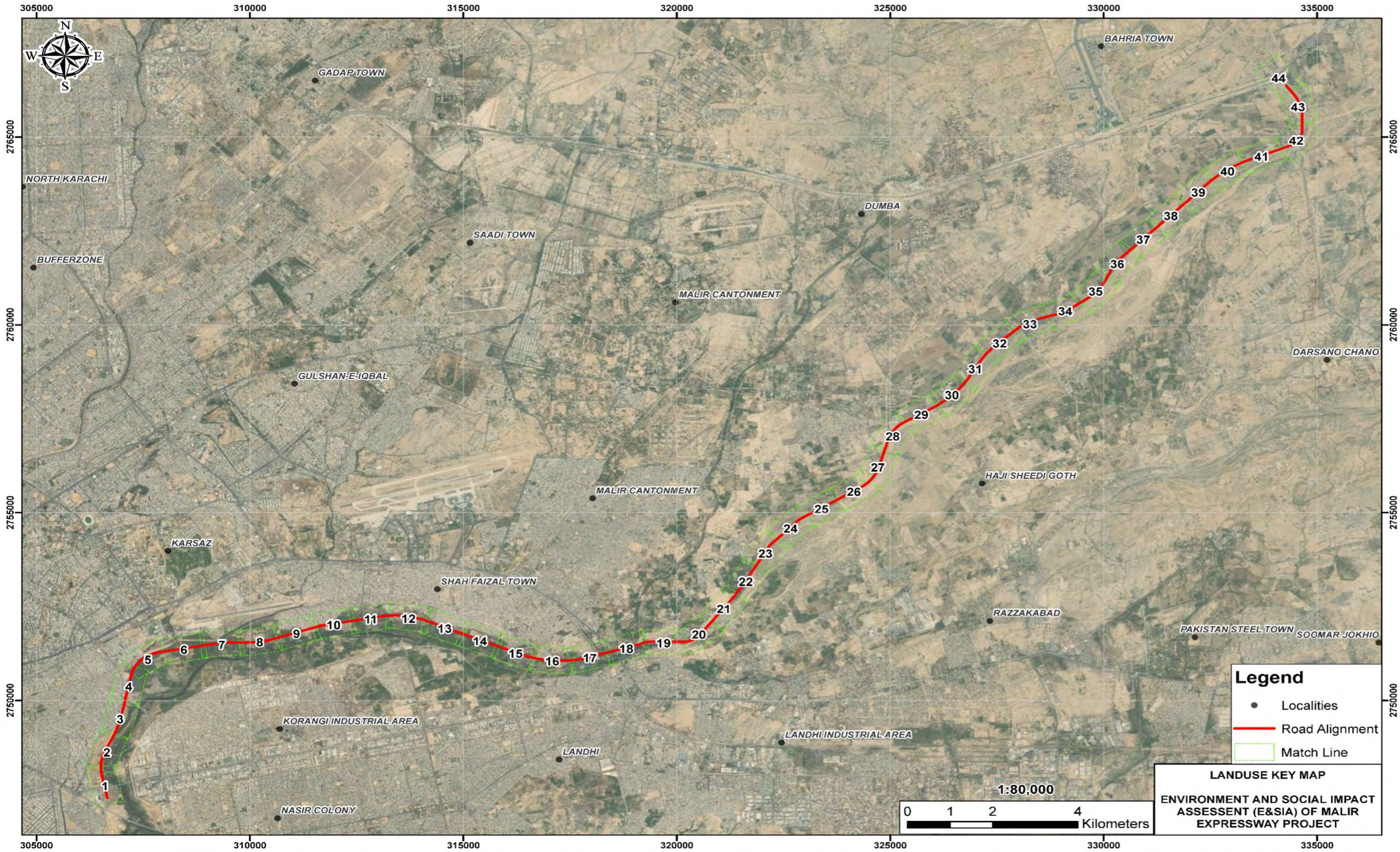


Figure 5.9: Landuse Index Map

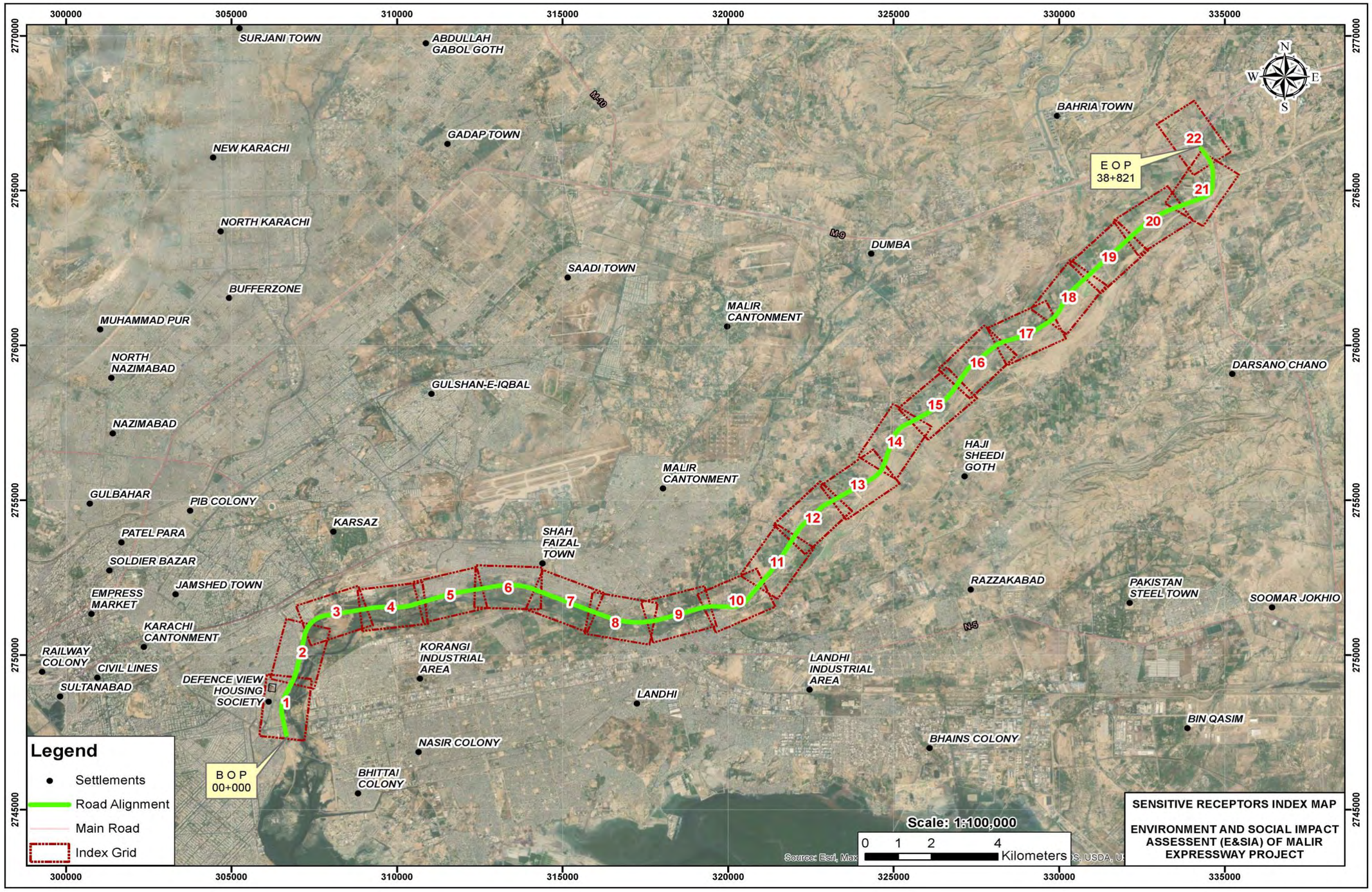


Figure 5.10: Potential Sensitive Receptor Index Map

5.5 ECOLOGICAL ENVIRONMENT

218. To compile the biodiversity in the vicinity of the proposed Project location, the data and information were obtained from secondary data from published literature and consultations with the concerned quarters. The Integrated Biodiversity Assessment Tool (IBAT) was also utilized to carry out the initial ecological based screening of the area. The information/data of IBAT was further refined and verified by utilization of various tools including literature review, stakeholders/departmental consultations, and random ground truthing.

219. Information regarding the field based (firsthand) ecological profile of Study Area was gathered through desk study, Consultation with concerned field formations of provincial departments of forestry, wildlife sectors and field visit to obtain the information regarding flora and fauna.

5.5.1 Ecological Context

220. Ecologically, the area falls constitutes tropical thorn forests with a degraded status of the indigenous biodiversity. The ecological zone is included in the Indus eco region which covers about 65% of the land area of Sindh Province. Being included in the Indus eco region, the flora and fauna of the Project site is linked with an indo-malayan bio geographical origin. With regards to micro-ecological response, the flora and fauna of greater Karachi can be divided into the following three edaphic regions:

- The coastal landscape and the muddy coastal swamps.
- The costal sand dunes.
- The barren undulating landscape of calcareous rocky terrain.

221. The above-mentioned contrasting edaphic conditions support different kinds of flora and fauna due to variable ecological conditions. The Project site is in a landscape with poor eco system. The barren undulating landscape is deprived of healthy environment and reveals absence of a food chain required for the existence and survival of terrestrial fauna.

5.5.2 Habitation

222. In general, Karachi is an urban environment. The natural fauna and flora-based ecosystems and species are less significant and low in count. Due to disturbances and absence of favorable habitats, the faunal frequency is observed to be low in the Project Area. While on the other hand it is important to note that the Project Area is adjacent to coastline therefore, few terrestrial grasses have been observed. However, the coastline is already facing serious environmental stresses mainly due to untreated wastewater flowing through the Malir River from various industries, where the surviving species in the river are observed to be in deplorable conditions. The principal habitat type in the Project Area along the course of Malir River to central areas of Karachi City are arid hills, and low-lying sandy areas. Vegetation of the hill slopes and hillsides comprise mainly

camelthorn (Prosopis spicigera) wild caper (Capparis Decidua) and large succulents such as Euphorbia caudicifolia. The sandy areas are typically vegetated with a sparse cover of small trees such as Acacia senegal, Zizyphus nummularia and Prosopis cineraria.

5.5.3 Integrated Biodiversity Assessment Tool (IBAT)

223. The Integrated Biodiversity Assessment Tool (IBAT) is a web-based mapping and reporting tool used by companies, governments, researchers, and financial institutions to access global biodiversity datasets with which to make better decisions around the environment. The IBAT software was utilized to carry out the initial ecological screening and to identify the status of the potential wildlife species of significant occurrence in the specified CoI. The outcomes provided by the IBAT Proximity report were based on the large buffer ranging between one (01) km to 20 km at three (03) different locations along the proposed MEX alignment.

224. Based on the findings of IBAT Proximity report 1, initially 118 nos. of IUCN red list species were identified at point 1 i.e. starting point of MEX (Location: [25, 67.3] Date of analysis: 18 March, 2021 Buffers applied: 1 km | 5 km | 20 km). Two (02) protected areas (Hub Dam and Hub (river) Dam within buffer of 20km) and One (01) Key Biodiversity Areas (Kirthar National Park within the buffer of 20km) were identified within this buffer. However, the initial screening species identified by IBAT are potentially found within 50km of the area of interest.

225. Based on the findings of IBAT Proximity report 2, initially 118 nos. of IUCN red list species were identified at point 1 i.e., starting point of MEX (Location: [24.9, 67.4] Date of analysis: 18 March, 2021 Buffers applied: 20 km). Two (02) protected areas (Hub Dam and Hub(Hub) Dam within buffer of 20km) and no Key Biodiversity Area were identified within this buffer. However, the initial screening species identified by IBAT are potentially found within 50km of the area of interest.

226. Based on the findings of IBAT Proximity report 3, initially 113 nos. of IUCN red list species were identified at point 1 i.e. starting point of MEX (Location: [24.8, 67.1] Date of analysis: 18 March, 2021 Buffers applied: 1 km | 3 km | 5 km). No protected areas and Key Biodiversity Area were identified within this buffer. However, the initial screening species identified by IBAT are potentially found within 50km of the area of interest.

227. Like IBAT Proximity reports, the Freshwater IBAT Assessment reports were based on the large buffer ranging between one (01) km to 150 km upstream and downstream at three (03) different locations along the proposed MEX alignment.

228. Based on the findings of IBAT Freshwater reports 1, 2 and 3, initially 65 numbers of freshwater species present in selected sub-basin area of 2270 km^2. Out of these 65 species, two (02) downstream as well as upstream threatened species and eleven (11) downstream as well as upstream migratory species were identified at each point. Out of

these 65 species, there are 24 fish species and 14 Mollusca species. The eight (08) fish species are migratory in the covered basin area by IBAT. None of these migratory fish species has any concern with the Project Area because there is no sub basin having hydrological connection with the Project site.

229. The reports of IBAT Proximity and Freshwater are attached as **Annex X & XI**. As mentioned in the IBAT reports, *there is however a possibility of incomplete, incorrect, or out-of-date information. All findings in this report must be supported by further desktop review, consultation with experts and/or on-the-ground field assessment*. Based on this, the presence/confirmation of initially securitized IBAT species were verified/authenticated through various tools including literature review, stakeholders/departmental consultations, and random ground truthing. Based on the ground realities and values, the habitats in the study area have been assessed in detail which are as under:

5.5.3.1 Literature Review

230. The extensive literature and research papers were thoroughly reviewed which majorly deal with the habitat and biodiversity features of the proposed MEX Project Area.

231. Commercial and residential development can impact the connectivity of the landscape, which is important for species persistence and maintaining genetic diversity, however, wildlife populations can tolerate some fragmentation if critical movement corridors are maintained otherwise a single change and alteration can lead to habitat modification.

232. With such heavy population pressure and consequential heavy demand on natural resources, sustaining forests even at a current level seems an uphill task as remaining meagre forest resources are insufficient to fulfil the demand for timber fuelwood and Non-Timber, Forest Products (NTFPs) on a sustainable basis. Demographic data suggests that the existing pressure from further increase in population will further rise when 76[11] % of the population in less than 25 years (41.6 percent under 15 and 34.5 percent from 16 to 25 years of age) will begin to construct new homes. In view of future planning, housing societies are mushrooming especially in mega cities like Karachi. Due to land hunger and lust for money, many big investors are grabbing forest lands resulting in resource depletion.

233. A Study conducted by Abid Qaiyum Suleri in 2007[12], stated that important factors contributing to the diminishing forest resources in Pakistan are basically the population growth, unsustainable forest management, energy requirements (fuelwood continues to be the major source of household energy in Pakistan), over grazing and timber harvesting.

[11] *(FAO- Forest sector review: Pakistan-2019)*

[12] *A Critical Analysis of Forest Policies of Pakistan: Implications for Sustainable Livelihoods, Babar Shahbaz, Tanvir Ali & Abid Qaiyum Suleri, Mitigation and Adaptation Strategies for Global Change volume 12, pages 441–453(2007).*

234. The upsurge in housing societies and development projects in Pakistan has accelerated deforestation in the country. Deforestation in Pakistan is alarmingly increasing as Pakistan Institute of Forests (PFI) in 2004, recorded deforestation rate in the country at 27,000 hectares per year. However, United Nations Food and Agriculture Organization (FAO)'s state of forest report documents a mammoth increase to 41,000 hectares' deforestation rate per year in Pakistan.

235. A study conducted by Dr. Naila Nazir (Assistant professor, University of Peshawar) stated that Pakistan since 1992 is losing about 13,000 hectares of forests every year. She further explained that land use change in a mountainous area of Pakistan situated in the Hindu-Kush Himalayan Region has been studied. Geophysical and geographical factors related to land use change over the years 1968, 1990 and 2007 showed that at high altitude there is 30.5% loss in forest area, out of which a third is caused by agricultural expansion. In the lower altitudes, total agricultural expansion was 129.9 % that consumed 31.7 % of the forest area over a forty-year period. In the middle elevation, forests decreased by 49.7% and agriculture expanded by 70.3%[13].

236. To record every possible species in the study area, the available literature was collected and reviewed. The literature included published and unpublished reports and books of private and government conservation organizations, books and brochures from forest and wildlife departments, research articles, popular articles, and newspapers. Based on the available literature, a checklist of different species was developed which was confirmed through observing different species during the survey. Most of the reptiles were observed during field visits

5.5.3.2 Focus Group Discussions (FGDs)

237. FGDs were conducted during the field visits with the stakeholder community members of different ages and at different locations of the Project Area, where details of the proposed Project were shared for better understanding of Project related activities.

238. Interviews with residents are valuable not only for the survey site selection but also in identifying the potential areas which may serve as a good source of primary data about the existing fauna and flora of the area. This method was very helpful in locating all the study sites. The focus of the engagements was getting an idea of the local inhabitants regarding ecological/natural resources of the targeted area. The locals of the Project Area shared that non availability of alternative resources in past severely damaged the green cover of the area and no such type of habitats and forest are present. The native wildlife species have mostly disappeared because of human induced activities and climate change. Now the available habitat is quite degraded due to forest destruction, uncontrolled hunting and grazing resulting in loss of habitat for wildlife as the result of non-environmentally friendly activities. The wildlife of the Project Area relates to forests, so, after damaging the tree cover, wild species of the area have almost vanished and

[13] *'Forest Area and Land Use Change in Pakistan: A System Dynamics Approach', Dr. Naila Nazir and Dr. Laura Schmitt Olabisi, 2015.*

hardly any common wild fauna (as given in baseline) is reported. In the last few decades. The unplanned commercialization is playing a major role in damaging the local habitats (flora and fauna) where the land use has been converted from its original status/shape to anthropogenic structures, which led to the disappearance of many ecologically important species of the area.

5.5.3.3 Field Observations

239. The findings of the literature review and FGDs were verified during the field observations. Observations were recorded on the sites during field survey and different ecological aspects were considered for establishing a baseline at different areas. Most of the soil was found degraded due to anthropogenic activities of the local masses. The vegetation cover was found to be extremely poor and with open canopy cover, altered from original conditions which were once healthy forests and was home to different wildlife species including mammals, reptiles, amphibians, and avifauna. The habitats for wild species were found to be unsuitable and detreated, only those species are surviving which have adopted the current physiological and climatic conditions prevalent.

240. The problem is severe and regional in nature because of conversion of forest land into agricultural lands and the increase in fuel wood supply; the rate of forest devastation in the Project Area is alarming which led to disappearance of many plants and wildlife species and shrinkages of habitats. The ecosystem basic functions of the Project Area are damaged and not working properly.

5.5.3.4 Site Specific Field Data and Primary Observations

241. The Consultant carried out a detailed survey to assess flora and fauna of the MEX Project Area. Habitat characteristics along with flora and fauna diversity has been observed in detail, where no legally and ecologically protected/ important sites related to localized habitats were found, and the overall area was termed as a degraded habitat.

Vegetation Surveys

242. A comprehensive field survey plan was prepared for flora baseline data collection. Dominant vegetation types/habitats have been identified in the Study Area. The vegetation in these habitats was recorded for the identification of species and coverage.

Faunal Surveys

243. In the study area, different parameters were considered while collecting data including secondary data collection, field surveys, consultations with forest and wildlife departments. A Field survey were organized with the help of local people. The background information was collected from wildlife departments and then further confirmed during field surveys. Different mammals, reptiles and bird's species were recorded on the pre-designed data sheets and then were organized in the ecological baseline.

244. Moreover, to detect the presence of wild fauna in the Project site, indirect methods were also used including foot-tracks and road kills.

245. Reptiles and amphibians are unable to maintain their habitats (shelter and food) because of severe/extreme anthropogenic pressure which leads to destruction, the species native are mostly extinct or migrated. It was observed that these habitats are now converted into commercial buildings and some as agricultural land use.

5.5.3.5 Departmental Consultations

246. The departmental consultations (with Forest and Wildlife Department) were carried out as per the methodology adopted. These departments were consulted during the field visits to discuss and evaluate the current forests conditions, wildlife status, trends, and possible impacts on the present native species due to Project interventions. The officials shared their views that due to human induced activities on a large-scale involving tree cutting for fuel wood and timber requirements, over grazing, Hunting and poaching of precious wildlife species, soil disturbances due to developmental activities, malicious fire and grass cutting, the proposed Project Area has been degraded in terms of flora and fauna presence.

247. The concerned departments mentioned that the entire ecosystem is under degradation due to illicit cuttings of trees, illegal hunting and poaching of wildlife species, overgrazing, over exploitation of natural resources, fires, and other biotic factors. The illicit cutting of trees, damages to soil and wildlife disturbances is common in the region and the concerned departments are trying their best to deal with the violators and to protect the precious natural resource.

5.5.3.6 Conclusion

248. After the consideration of all the above process, it was concluded that the identified species of IBAT are far away from the CoI of the Project Area or even outdated and some factually incorrect. Based on the above verifications and authentication through best available sources, only few species of IBAT exist in the Project CoI which have been included in the upcoming sections of this report. It is investigated that there are no species of conservation importance, endemic species, endangered, critically endangered, etc. in the Project CoI.

5.5.4 Legal Status of the Project Area / Project Site

249. The Project site of Malir Expressway is in a barren/degraded tract and is not classified as a biodiversity hotspot. Due to the extremely poor conditions of flora and fauna, the site had not availed the status of designated forests land under the provision of Forest Act 1927 and does not qualify as candidate site for notified game reserve under Sindh Wildlife Protection Act, 2020. However, legal jurisdiction of Forest Act 1927 and Sindh Wildlife Protection Act 2020 is applicable in the area. The area is rated as unproductive

waste land. The nearest protected area "Kirther National Park" is located almost 70-75km from the proposed route of MEX and therefore it has no relevance with the proposed project.

5.5.5 Flora

250. As the climatic conditions are harsh, it is difficult for flora to survive under these unfavorable conditions, which are further augmented by drought and land clearance activities on account of rapid urbanization. As a result, vegetation is sparse and scanty.

251. Natural areas of vegetation are restricted to depression areas where moisture is available for greater part of the year and longer periods of time. The native vegetation is of the desert scrub type. As the Project Area is mostly passing through urban areas, so the soil is non-supportive for the flora to establish roots and chains, and mesquite (the invader species) is dominant and has invaded the eco-system and is currently representing the monoculture which is not best indicator of biodiversity.

5.5.5.1 Trees

252. Trees commonly found in the Project Area and the surrounding area is as follows in below **Table 5.12.**

Table 5.12: Trees in the Project Area

Sr. No.	Common Name	Scientific Name	Conservation Status
1.	Neem	*Azadirachta indica*	*LC*
2.	Pilkhan (white Fig)	*Ficus virens*	*LC*
3.	Jungle jalebi	*Pithecellobium dulce*	LC
4.	Karir	*Capparis decidua/aphylia*	*LC*
5.	Babul	*Acacia nilotica*	*LC*
6.	Khabar	*Salvadora oleoides*	*DD*
7.	Ber	*ziziphus mauritiana/jajuba*	*LC*
8.	Kandi	*Prosopsis Senegal*	*NF*
9.	Lai	*Tamarix gallica*	*LC*
10.	Frash	*Tamarix aphylla,*	*NF*
11.	Willo or baban	*Salix alba*	*LC*
12.	Poplar	*Populus euphratica,*	*LC*
13.	Sirris	*Acacia lebbek*	*LC*
14.	Pipal	*Ficus religiosa*	*NF*
15.	Malah	*Zizyphus nummularia,*	*NF*
16.	Date palm	*Phoenix dactylifera*	*LC*
17.	Coconut	*Cocos nucifera L*	*NF*
18.	Conocarpus	*Conocarpus erectus*	*LC*

LC – Least Concern
NF – Not Found

5.5.5.2 Shrubs and Grasses

253. Shrubs found in the area are such as:

1. Grewia tenax,
2. Seddera latifolia,
3. Rhazya stricta,
4. Leptadenia pyrotechnica,
5. Colotropis procera,
6. Inula grantioides,
7. Zygophyllum,
8. Sueda fruticose
9. Indigofera oblongifolia
10. Euphorbia caducifoli

5.5.5.3 Grasses

254. Grasses commonly found in the area are as follows

1. Ochthochloa compressa,
2. Cymbopogon jawarancussand
3. Aristida funiculate.

255. The above combination of species makes up most of the total vegetation coverage of Project Area.

5.5.6 Fauna

256. The Environments for flourishing of faunal species is not present along the CoI, as these lands are impoverished and degraded, resulting from non-availability of surface as well as groundwater and discharge of untreated wastewater into Malir River. This process has irreversibly reduced the biodiversity of the indigenous and any introduced vegetation and hence it offers very little chance for the survival/growth of fauna in the macro environment of Project Area. There are even otherwise, no habitats of large and small animals, birds, or reptiles within or near the Project site. Domestic livestock, particularly goats, sheep, and camels are found grazing in the suburban towns.

257. There are several characteristic bird species that have adapted to the agricultural environment in the areas, where our Project Road passes through or close to agricultural areas, along Malir River. These include Indian Roller, Common mynah, pigeon, and house sparrow.

5.5.6.1 Mammals

258. Large and small mammals commonly found in the Project Area and the surrounding area are shown in **Table 5.13** and **Table 5.14** below:

Table 5.13: Large Mammals in the Project Area

Sr. No.	Common Name	Scientific Name	Conservation Status
1	Jackal	*Canis aureus*	*LC*
2	Fox	*Vulpus*	*LC*

Table 5.14: Small Mammals in the Project Area

Sr. No.	Common Name	Scientific Name	Conservation Status
1	Hare	Lepus tinidus	*LC*
2	Hedge Hog	Hemiechinu sauritus	*LC*
3	Mouse	Musmus culus	*LC*
4	Common Mongoose	Herpestesed wardsii	*LC*
5	Porcupine	Hystrix indica	*LC*

5.5.6.2 Reptiles

259. The tract is diversified with the presence of wetland, agricultural lands, and wasteland along Malir Riverbank and therefore, is characterized by the presence of a variety of reptiles. The commonly found reptiles in the Project Area are presented in **Table 5.15**

Table 5.15: Reptiles in the Project Area

Sr. No.	Common Name	Scientific Name	Conservation Status
1.	Viperine Sea Snake	Praescutataviperina	*LC*
2.	Annulated Sea Snake	Hydrophiscyancinctus	*LC*
3.	Common Sand Lizard	Lacertaagilis	*LC*

5.5.6.3 Birds

260. Ecological diversity of the Malir Riverbanks and estuary is complex in nature consisting of interrelated components of land and sea, and therefore, comprises of variety of migratory and resident birds.

261. In the site of Malir River and its adjoining areas, no endangered bird species exist. The proposed project is also not falling in migratory bird flyway (migration corridor). Some flying birds including common birds like Sparrows, Crows, Bulbuls, Mynas and Egrets are commonly observed. Birds, commonly found in and around the Project site are presented in the **Table 5.16.**

Table 5.16: Birds in the Project Area

Sr. No.	Common Name	Scientific Name	Conservation Status
1.	Herring Gull	*Larusargentatus*	*LC*
2.	Sanderling	*Calidris alba*	*LC*
3.	Pariah kite	*Milvusmigrans*	*LC*
4	Mynah	*Acridotheros tristis*	*LC*
5.	Bulbul	*Pycnontidae*	*LC*
6.	House Sparrow	*Passer domesticus*	*LC*
7.	House Crow	*Corvus splendens*	*LC*

Sr. No.	Common Name	Scientific Name	Conservation Status
8.	Heron	*Ardeolagrayii*	*LC*
9.	Egret	*Egrettagarzetta*	*LC*
10.	Plover	*Charadriinae*	*LC*
11.	Black headed Gull	*Chroicocephalus ridibundus*	*LC*
12.	Little Tern	*Sterna albifrons*	*LC*
13.	Herring Gull	*Larusargentatus*	*LC*
14.	Sanderling	*Calidris alba*	*LC*
15.	Pariah kite	*Milvusmigrans*	*LC*
16.	Common Pochard	*Aythya ferina*	*VU*

5.5.7 Aquatic Fauna

262. The proposed MEX alignment will pass along and through a few water bodies as mentioned above.

263. A site survey was conducted by an Aquatic Ecologist for the aquatic communities of the Malir River from its mouth/ draining point in the Arabian Sea to the end of proposed Malir Expressway near Karachi Education City on left bank and Karachi Bahria Town on right bank at its upstream. The study area is about 40 km i.e., 36 km upstream and 4 km downstream of Jam Sadiq Bridge on Korangi Road (refer **Figure 5.14**). Study details are discussed as follows:

- Methodology;
- Physical description of the study area(s);
- Water quality; and
- Habitat classification and characterization along with the study of the aquatic ecology.

5.5.7.1 Methodology

264. The methodology comprised two approaches:

- Primary Data Collection; and
- Secondary Data Collection.

a) Primary Data Collection

265. Physical survey (refer **Plate No. 01**) of the Malir River from zero point of the alignment of the proposed Expressway to the downstream of the Malir Dam where the proposed Expressway joins the N5 - M9 Link Road.

Findings

266. The stretch from EBM causeway to the downstream of the Malir Dam has few depressions having polluted water, especially at some places where big settlements like Shah Faisal Colony, Malir River is flowing with sewage and industrial wastewater. The

sewage water is heavily infested with organic load while industrial wastewater is highly polluted with inorganic load. Two fish species, *Channa punctatus* (Dola) - *IUCN status: LC* and *Oreochromis mosambicus* (Wild tilapia) - *IUCN status: LC* are found in few stretches of river where sewage water is added near the surface. These are very resilient species and live in stagnant waters. These are wild and weed fish which have no commercial importance.

b) Secondary Data Collection

267. Secondary sources used for collection of the baseline data of Malir River Aquatic Ecology with reference to the Malir Expressway Project are:

- Feasibility Report of the Project,
- Research papers published on the water quality of the Malir River,
- Meetings with the locals, and
- Fisheries Department Sindh.



Consultation with public with reference to fish in Jam Sadiq area.



View of Malir River, Ghazi Daood Brohi Bridge. Sewage water with no fish.



Consultation in Deputy Director Fisheries Office Karachi



Consultation in Director General Fisheries Office Karachi.

Plate No. 1: Primary and Secondary Data Collection at Site

5.5.7.2 Physical Description of the Project Area with Respect to Aquatic Fauna

268. Malir River, based on the study is divided into following four (04) sections (refer **Figure 5.14**):

- Downstream of the PARCO elevated pipeline up to the main sea. This area has different types of typical mangrove area species such as fin fish, shrimps, and invertebrates living in soft mud with mangrove roots. This area is not part of the Project Area;
- Upstream of PARCO elevated pipeline to Jam Sadiq Bridge on Korangi Road. This area is semi mangrove type having thin and scattered mangrove and mesquite plants therein. No significant aquatic life due to effect of the polluted water. This area is also not part of the Project Area;
- Jam Sadiq Bridge to EBM causeway which receive industrial effluents from Korangi Industrial area. It has scattered ponds having stagnant polluted water. This water has no Aquatic life; and
- EBM causeway to the proposed end of the Malir Expressway which has few depressions having polluted water. At some places where big settlements like Shah Faisal colony, Malir River is flowing with sewage and industrial wastewater. However, two fish species, Channa punctatus (Dola) and Oreochromis mosambicus (Wild tilapia) are found in some stretches where sewage is being discharged near the surface. These are very resilient species and live in stagnant dirty waters. These are very common and have no commercial importance. Due to the non-perennial nature of Malir river, the riverbed/flood area starting from upstream of the EBM causeway is being used for agriculture purpose at most of the places.

5.5.7.3 Malir River Water Quality

269. There are two main rivers in Karachi Lyari and Malir. 3/4 of the industries of Karachi are discharging their effluents into the Lyari and Malir Rivers and the rest into different channels including Malir River and both the rivers enter the sea. The waste generated from the industries and other sources contain organic and inorganic pollutants. The industrial wastewater contains heavy metals and is a real problem to marine and terrestrial ecosystems because they do not decompose and remain in the ecosystem

270. The site survey was conducted and it was observed that the water quality is worse than before due to increase in industries and urbanization in and around Malir River. The Study Area section of Malir River is currently used for diluting and assimilating sewage and industrial effluents. Sewage is discharged at a point just upstream of PARCO Elevated pipeline on the right riverbank. The presence of the Korangi Industrial Area on the left side of the riverbank is a source of industrial effluent discharge in the Study Area section of Malir River. These sewage and industrial effluent discharges makes the Malir River highly polluted right before it flows into the Arabian Sea. While Malir River is generally considered to be a polluted river, especially near the Study Area due to the

presence of the Defence Housing Authority (DHA) sewage drainpipe and the Korangi Industrial Area, there is little water quality analysis in published literature to support it. Only one study documents the water quality of Malir River near Qayyumabad district (as well as other spots upstream of Malir River), which is part of the Study Area. This study [Bano and Farida, 1999] documented high levels of pollutants in Malir River near Qayyumabad[14]. Chemical parameters such as salinity, pH, total dissolved solids (TDS), turbidity and sediment were considerably high as compared to other parts of the river upstream. These high concentrations were attributed to the municipal sewage and industrial effluent discharged into Malir River.

[14] *Bano, F., Rizvi, S. N., Begum, F., & Farooq, S. (2009). Assessment of water quality for the determination of extent of pollution in Malir River. Int J Biol Biotech, 6(1-2), 61-6.*

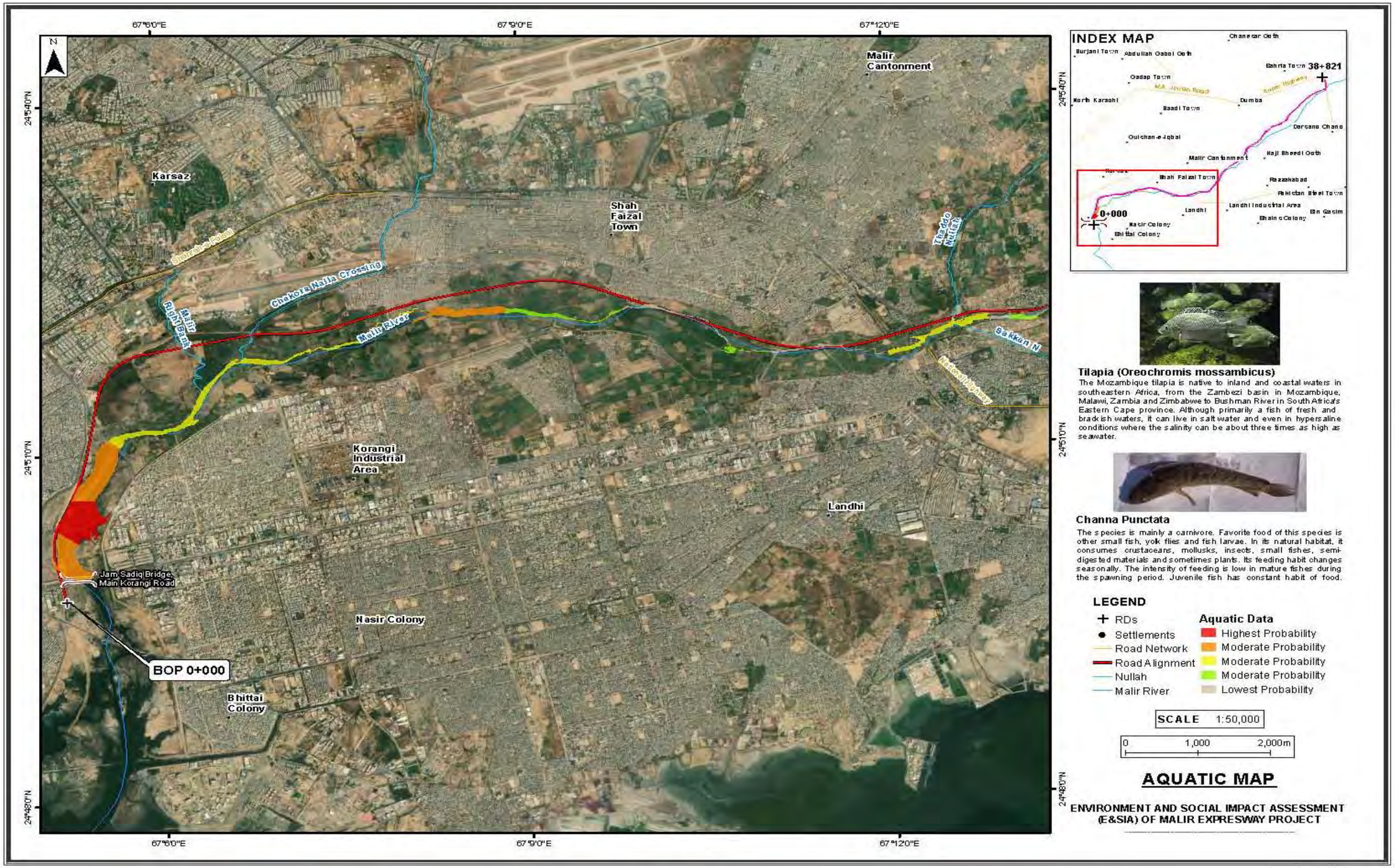


Figure 5.11: Map of Fish Species Location along the MEX

5.5.7.4 Aquatic/Fish Species in the Project Area

271. The Malir River is a seasonal river which remains dry due to scanty rainfalls in the area. Its downstream region has become perennial due to continuous flow of sewage and industrial water. Aquatic pollution in this area has resulted in physical, chemical, and biological deterioration of its water bodies causing destruction of biota. However, some of its water bodies / depressions /ponds /ditches have only two fish species (Tilapia and Channa) which are surviving there in peripheral areas. These fish species are very resilient and can survive even in waters having no dissolved Oxygen therein. They have symbiotic relations with each other. A comprehensive assessment on the aquatic ecology was conducted by review of the baseline literature, detailed survey of the Project Area and discussions with the inland and coastal areas Fisheries Department Sindh.

272. There are two types of fish species (see **Figure 5.15**) that has been reported during the site survey and during the consultation with the Office of Director Marine Fisheries. These are:

- Tilapia (Oreochromis mossambicus
- Channa punctate



Tilapia (Oreochromis mossambicus)



Channa punctata

Figure 5.12: Fish species reported in the Malir River

273. The details are here under:

a) Tilapia (Oreochromis mossambicus)

Distribution and Habitat

274. The Mozambique tilapia is native to inland and coastal waters in southeastern Africa, from the Zambezi basin in Mozambique, Malawi, Zambia and Zimbabwe to Bushman River in South Africa's Eastern Cape Province.

275. It is a remarkably robust and productive fish, readily adapting to available food sources and breeding under suboptimal conditions. Although primarily a fish of fresh and brackish waters, it can live in salt water and even in hyper-saline conditions where the salinity can be about three times as high as seawater. Among others, it occurs in rivers, streams, canals, ponds, lakes, swamps, and estuaries, although it typically avoids fast-

flowing waters, waters at high altitudes and the open sea. It inhabits waters that range from 17 to 35 °C (63–95 °F)[15].

Scientific Classification:

Kingdom:	Animalia
Phylum:	Chordata
Class:	Actinopterygii
Order:	Cichliformes
Family:	Cichlidae
Genus:	Oreochromis
Species:	O. mossambicus

276. The Mozambique tilapia or hybrids involving this species and other tilapia are invasive in many parts of the world outside their native range, having escaped from aquaculture or been deliberately introduced to control mosquitoes. The Mozambique tilapia has been nominated by the Invasive Species Specialist Group as one of the 100[16] worst invasive species in the world. It can harm native fish populations through competition for food and nesting space, as well as by directly consuming small fish.

Feeding[17]:

277. Mozambique tilapia are omnivorous. They can consume detritus, diatoms, invertebrates, small fry and vegetation ranging from macroalgae to rooted plants. This broad diet helps the species thrive in diverse locations.

278. Due to their robust nature, Mozambique tilapias often over-colonize the habitat around them, eventually becoming the most abundant species in a particular area. When over-crowding happens and resources get scarce, adults will sometimes cannibalize the young for more nutrients. Mozambique tilapia, like other fish such as Nile tilapia and trout, are opportunistic omnivores and will feed on algae, plant matter, organic particles, small invertebrates and other fish.

Reproduction[18]:

279. In the first step in the reproductive cycle for Mozambique tilapia, males excavate a nest into which a female can lay her eggs. After the eggs are laid, the male fertilizes them. Then the female stores the eggs in her mouth until the fry hatch; this act is called mouthbrooding. One of the main reasons behind the aggressive actions of Mozambique

[15] *Ford, A.G.P.; et al. (2019). "Molecular phylogeny of Oreochromis (Cichlidae: Oreochromini) reveals mito-nuclear discordance and multiple colonisation of adverse aquatic environments". Mol. Phylogenet. Evol. 136: 215–226.*
[16] *Froese, Rainer and Pauly, Daniel, eds. (2019). "Oreochromis mossambicus" in FishBase. September 2019 version.*
[17] *"Biology and ecology of Mozambique tilapia (Oreochromis mossambicus)". feral.org.au. Archived from the original on 29 October 2013.*
[18] *Oliveira, R. F.; Almada, V. C. (1 June 1998). "Mating tactics and male-male courtship in the lek-breeding cichlid Oreochromis mossambicus". Journal of Fish Biology. 52 (6): 1115–1129.*

tilapias is access to reproductive mates. The designation of Mozambique tilapias as an invasive species rest on their life-history traits: Tilapias exhibit high levels of parental care as well as the capacity to spawn multiple broods through an extended reproductive season, both contributing to their success in varying environments. Mozambique tilapias can occupy many niches during spawning since the young can be transported in the mouth. These proficient reproductive strategies may be the cause behind their invasive tendencies.

Published Study on Oreochromis mossambicus

280. A study[19] of the fish fauna of Malir River was conducted. Oreochromis mossambicus, which is the most common fish of this river, was selected as a sample species to see the effects of pollution on fish fauna. Groups of 20 fishes of this specie were captured monthly by hand net from four (04) spots in upper and lower Malir River. Spot 1 (Murad Memon Goth) is located 3.5 Km away from Malir City, spot 2 (Malir City) located near Malir City; Spot 3 (Drigh Road) is dominated by agricultural lands and Spot 4 (Quyumabad) which receives industrial and domestic waste in lower Malir River.

281. During this study, the variation in length and weight data of Oreochromis mossambicus was observed during the study period. The length was found generally to vary between 20.1 - 36.11 cm at Spot 1 while at Spot 2 the maximum length of 30.80cm was observed. The length of Oreochromis mossambicus varied between 20.25 - 38.88 cm at spot 3 while at Spot 4 it showed a variation of 18.92 – 32.75 cm. The length and weight of Oreochromis mossambicus shows fluctuation throughout different seasons during which study was conducted. Average length and weight generally decline during June-July and in November-December at Spot 1 and 2 in lower Malir River. The data obtained from Spot 1 and Spot 2 respectively shows little variation in length and weight of the fish. At Spot 3 the length and weight data shows sharp decline in March and November except during the first year of study, whereas little variation in the length and weight of Oreochromis mossambicus was observed at spot 4.

282. The variation and irregular pattern of length and weight data of Oreochromis mossambicus shows that the growth of this fish may affected by the variations in the physio-chemical conditions in Malir River. This indicates the deteriorating water condition.

b) Channa Punctata

283. Channa punctata, the spotted snakehead, is a species of snakehead. It is found in the Indian Subcontinent and nearby areas, ranging across Afghanistan, Pakistan, India, Sri Lanka, Nepal, Bangladesh, Myanmar and Tibet. Its natural habitats are swamps, ponds and brackish water systems. It is a fish of high food value and has little value as aquarium fish.

[19] *Variations in Length and Weight of Oreochromis mossambicus in Malir River, Karachi, Pakistan, Farida Bano, Syeda Nazneen Rizvi and Sumera Farooq, Journal of Basic & Applied Sciences, 2012, 8, 169-173*

Scientific Classification:

Kingdom:	Animalia
Phylum:	Chordata
Class:	Actinopterygii
Order:	Anabantiformes
Family:	Channidae
Genus:	Channa
Species:	C. punctate

Description:

284. Channa punctatus normally grows to around 15.0 cm[20] (5.9 in) in length, but males up to 31.0 cm (12.2 in) have also been captured. The spotted snakehead is listed as 'Least Concern' in 'IUCN Red List of Threatened Species' due to lack of major threats to this species populations.

285. The species is mainly a carnivore. Favorite food of this species is other small fish, yolk flies and fish larvae. In its natural habitat, it consumes crustaceans, mollusks, insects, small fishes, semi-digested materials and sometimes plants. It's feeding habit changes seasonally. The intensity of feeding is low in mature fishes during the spawning period.

5.5.7.5 Fish Population Status

286. Fish population is very thin and rare in some of the water bodies in the river. Exact stock assessment is not possible as it requires complete data of each water body and different life stages of the fish species in different seasons. As such the stock assessment is not the requirement of this study.

5.5.7.6 Fish Production Level

287. There is neither any fisheries of these fish in the Project Area nor exact stock assessment of these water bodies, so fish production of the Project Area is not considerable.

5.5.7.7 Commercial Value of the Fish/Fisheries

288. Presently, there are no commercial fisheries in Malir River due to existing small dams in upstream of the Project Area and heavy water pollution in the Project Area. In the past, before partition of the continent, there used to be fishing /fisheries in Malir River but now it is impossible.

[20] *Froese, Rainer and Pauly, Daniel, eds. (2014). 'Channa punctata in Fish Base'. February 2014 version.*

5.5.8 Protected Areas / National Sanctuaries

289. In Pakistan there are several areas of land, devoted to the preservation of biodiversity through the dedication of national parks and wildlife sanctuaries. However, this kind of areas is not found near the Project site. No endangered fauna is reported in the Project Area.

5.5.9 Agriculture

290. Agricultural activities have been continuously degraded, due to rapid urbanization in the area and lack of water in the Malir River. The agriculture is restricted to only some areas, along the river, where irrigation is done with water from Malir River. During Kharif season wheat is grown, whereas principal crop during rabbi are vegetables and fodder.

5.5.10 Horticulture

291. The proposed Project route at few points fall in some orchards and vegetables garden. No significant horticulture practices were reported except few guava, papita and lemon gardens were observed. Some sporadic trees of Date Palm, Coconut and Jaman have also been reported in the study area.

5.6 SOCIO-ECONOMIC ASPECT

292. The socioeconomic aspect has been studied with respect to human and economic development and quality of life values of the population in the Project Area. The human and economic development mainly focuses on population and communities, industrial development, infrastructure availability, institutions, transportation network, prevailing land use, power sources and agricultural pattern. Quality of life includes socio-cultural values, public health situation, recreational resources & development, and archaeological/historical and cultural sites etc. Baseline information was gathered from literature, study reports, district census reports of Malir and Korangi Districts, 1998, 2017 and through field surveys comprising interviews and meetings by the Consultants' EIA team (Male and Female Sociologists and Environmentalists as mentioned in chapter 01). It is important to mention here that most of the demographic information (discussed under section 5.6 to 5.8.2) has been derived from PBS website which is updated according to census 2017. Whereas the rest of the information, which was not available on site, has been derived from census report of 1998 of concerned districts. During the field survey interviews and meetings with the different categories of respondents were held and observations were also recorded after giving due consideration during survey.

293. The proposed Project Area falls in the administrative jurisdiction of the Malir mainly and some and in the small portion of Korangi District, where the socio-economic survey focused on the Project Area and relevant information related to the district.

5.7 ADMINISTRATIVE SETUP AND POPULATION

5.7.1 Malir District

294. Malir district is an administrative district of Karachi Division in Sindh, Pakistan. In 2000, the Malir District was abolished and divided into three towns namely: Malir Town, Bin Qasim Town and Gadap Town. In 2011, Sindh Government restored Malir District again and in 2013, it formally started working as a new district[21]. The district derived its name from its headquarters town Malir. The word Malir, denotes basically a region of pastoral wealth, a patch of rich and fertile plain or meadow in Rajasthani, Saraiki and Sindhi. The total area of the Malir District is 2,635 square kilometers with population density 762.5/km² and lies between 24045' to 25037' north latitudes and 67006' to 67034' east longitudes.

5.7.1.1 Administrative Setup

295. The Malir District is bound on the north by Dadu District, on the south by Thatta District and Arabia Sea, on the east by Dadu and Thatta Districts and on the west by Karachi and Lasbela District of Baluchistan Province. The sub-divisions of District Malir are: Airport, Bin Qasim, Gadap, Ibrahim Hyderi, Murad Memon and Shah Mureed.

5.7.1.2 Population

296. According to Census of 2017[22], the population of Malir District is 2,008,901 with an average annual growth rate of 3.86 percent from 1998 to 2017. The male population of Malir District is more than the female population. Out of the total population, 53.5 percent are males and 46.5 percent are females and the sex ratio of the district is 115. According to census report 2017, the average household size for the district is 5.9 persons. **Figure 5.16** shows the graphical view of population by gender.

[21] *City District Government Karachi Archived 15 October 2013*
[22] Pakistan Bureau of Statistics

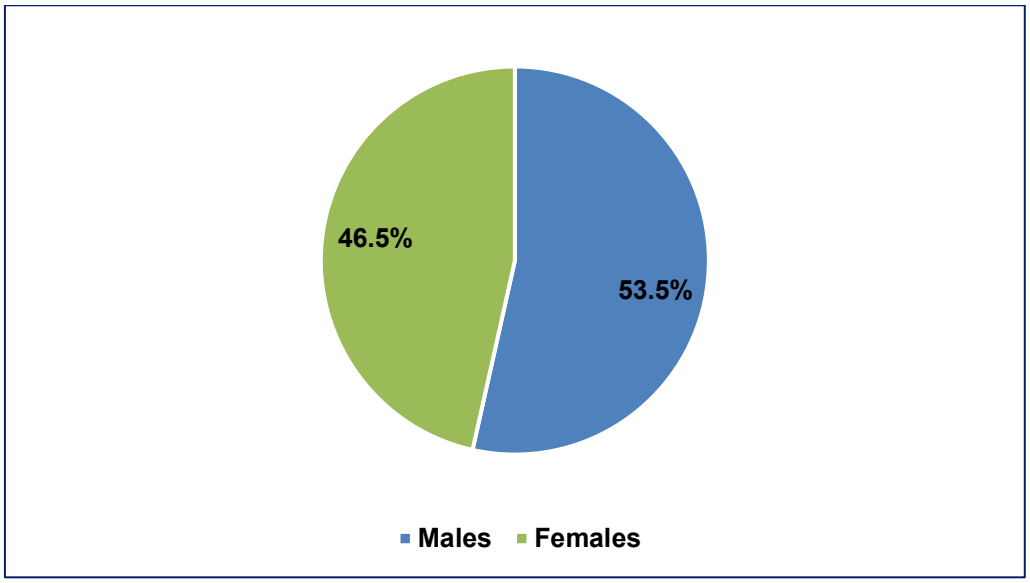


Figure 5.13: Population by Gender

5.7.1.3 Rural and Urban Distribution

297. According to the Census of 2017, the major portion of the district falls in the urban area having population of 1,153,616 constituting 57.4 percent of the total population, while the rural population of the district is 855,285 constituting 42.6 percent of the total population with households 188,551 in the urban area and 149,706 in rural. The rural and urban distribution of the population is shown in **Figure 5.17** below:

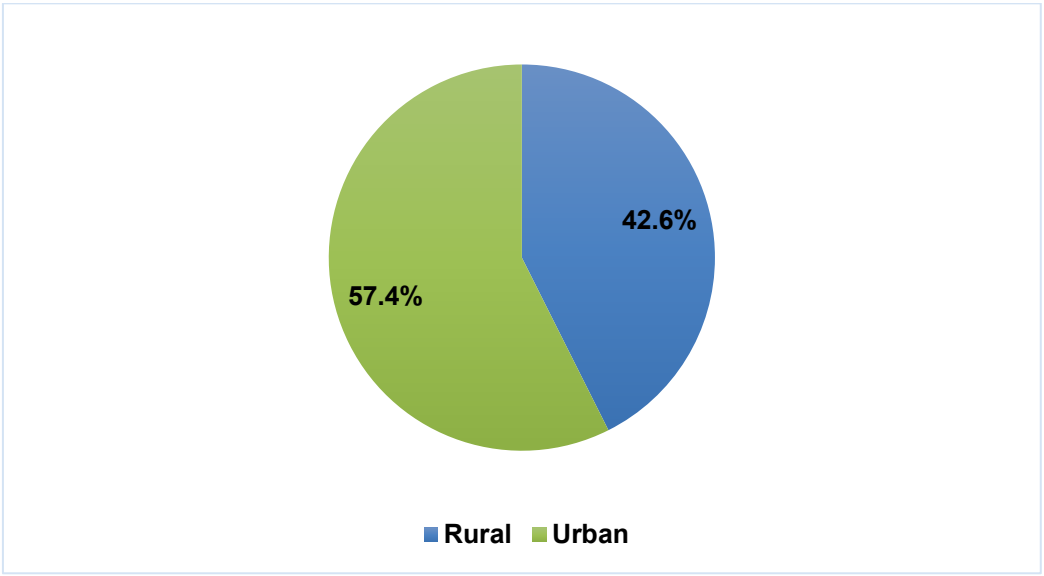


Figure 5.14: Rural and Urban Distribution of the Population

5.7.2 Korangi District

5.7.2.1 Administrative Setup

298. *Korangi district* is one of the seven administrative districts of Karachi, part of the Karachi Division in Sindh, Pakistan. The district was a part of District East in Karachi, which was divided in November 2013. The total area of the Korangi District is 94.8 square kilometers with population density 25,918/km² and lies between 24° 53′ 3.84″ north latitudes and 67° 8′ 39.48″ east longitudes. It has three administrative towns i.e. (i) Korangi Town, (ii) Landhi Town and (iii) Shah Faisal Town.

5.7.2.2 Population

299. According to Census of 2017 the population of Korangi District is 2,457,019. The male population of the district is more than the female population. Out of the total population, 52.3 percent are males and 47.7 percent are females and the sex ratio of the district is 109. According to census report 2017, the average household size for the district is 5.9 persons. **Figure 5.18** shows the graphical view of population by gender.

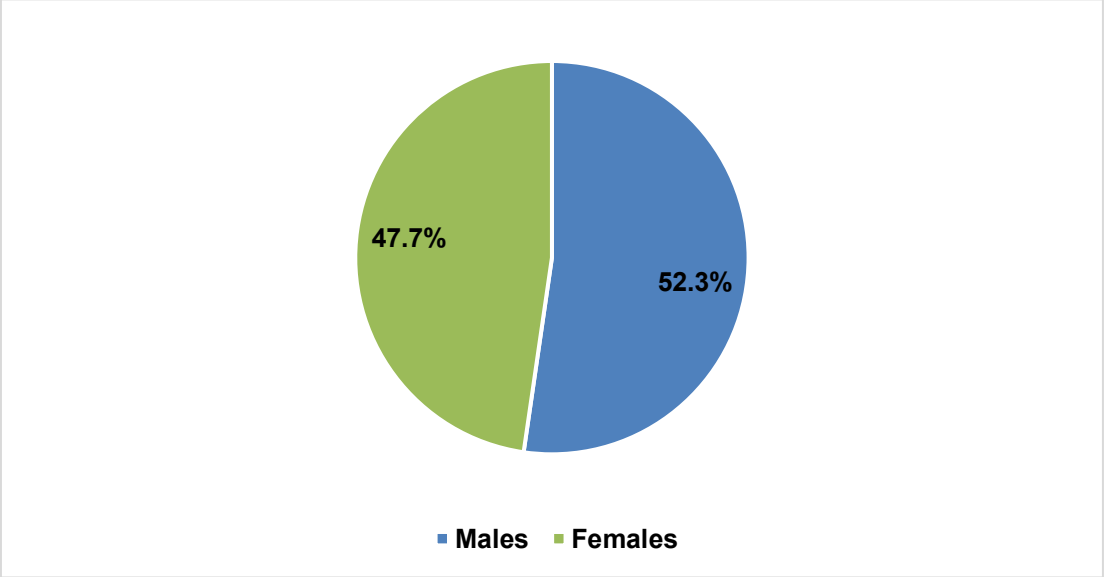


Figure 5.15: Population by Gender

5.7.2.3 Rural and Urban Distribution

300. According to Census of 2017, the district Korangi falls 100% in the urban area with 421,618 number of households.

5.7.3 Literacy Rate

301. *Malir District:* the female literacy rate in the district is 42.87 percent and the male literacy rate is 61.44 percent with average literacy rate of 53.56 percent. **Table 5.17** shows literacy ratio by sex in urban and rural areas of district.

Table 5.17: Literacy Ratio by Sex in Urban and Rural Areas, 1998[23]

Sr. No.	Area	Both Sexes	Male	Female
1.	All Areas	53.56	61.44	42.87
2.	Rural	49.16	58.57	38.05
3.	Urban	55.65	62.69	45.43

302. *Korangi District* was formed in 2013 hence, the literacy data of the district is not available in district census reports of 1998 separately.

5.7.4 Educational Institutes

303. Institute of Computer Sciences (FAST), Pakistan Swedish Institute of Technology and Cadet College in Gulshan-e- Hadeed are the institutes of national repute and are in the district besides government and private schools and colleges. However, the district being a part of Karachi metropolis / division, offers all type of educational facilities by providing the facility of higher studies in government universities like the Karachi University, the NED University of Engineering and Technology, Sindh Medical College and Dow Medical College of Sindh Government as well as Agha Khan Medical College and Sir Syed University of Engineering and Technology in private sector. Students both male and female from the district acquire higher studies in these institutions.

304. **Table 5.18** depicts number of educational institutions and enrolments of students in the district.

Table 5.18: Educational Institutions and Enrolments of Students, 1998[24]

Description	Primary	Secondary	High	Degree	Others
Institute / Enrollments	120	24	05	12	35
No. of Students	15,746	8,306	2,960	15,458	1,748

305. **Table 5.19** depicts number of educational institutions and enrolments of students in the urban and rural areas of district by sex.

Table 5.19: Educational Institutions and Enrolments of Students in the Urban and Rural Areas of District by Sex, 2016-2017[25]

Location	Level	Institutions				Enrolment		
		Total	Male	Female	Mixed	Total	Male	Female
Urban	Primary	124	26	18	80	11,095	5,267	5,828
	Middle	26	5	8	13	1,527	505	1,022
	Secondary	37	6	12	19	13,245	6,660	6,585
	Higher Secondary	1	--	--	1	456	178	278
Total		**188**	**37**	**38**	**113**	**26,323**	**12,610**	**13,713**
Rural	Primary	390	82	38	270	25,659	14,008	11,651
	Middle	54	10	30	14	4,456	2,047	2,409

[23] District Census Report Malir, 1998
[24] District Census Report Malir, 1998
[25] RSU-Sindh Education Management Information System (SEMIS), 2016-17

Location	Level	Institutions				Enrolment		
		Total	Male	Female	Mixed	Total	Male	Female
	Secondary	24	7	5	12	5,081	3,260	1,821
	Higher Secondary	7	--	2	5	5,362	2,623	2,739
Total		**475**	**99**	**75**	**301**	**40,558**	**21,938**	**18,620**
Total	Primary	514	108	56	350	36,754	19,275	17,479
	Middle	80	15	38	27	5,983	2,552	3,431
	Secondary	61	13	17	31	18,326	9,920	8,406
	Higher Secondary	8	--	2	6	5,818	2,801	3,017
Total		**663**	**136**	**113**	**414**	**66,881**	**34,548**	**32,333**

306. The major educational institution that is present around the Project Area (CoI) is Iqra University. However, various primary and secondary schools (government and private sector) are also present around the CoI.

5.7.5 Occupation and Employment

307. Malir and Korangi are industrial and commercial districts having multi-occupations. The main occupation of the people is business and trade. The other major portion of the population consists of labor class including skilled and unskilled labor. The remaining small portion of the district population is having different occupations including government and private service as well as agriculture. The women also assist their men in the economic activity in different fields of business, service, education, and other institutions. Mostly, the women are serving in schools, colleges and hospitals as teachers, lecturers, professors, nurses, doctors, and as elementary staff.

308. Among the employed population, 33.35 percent is self-employed (agriculture, business, and trade), 40.63 percent working as private employees (in private organizations, schools, colleges, universities, banks, and NGOs), 18.69 percent working as government and autonomous employees (in government departments, schools, colleges, universities, and banks) and 2.8 percent as unpaid family helpers. **Table 5.20** shows percentage of working population by employment status in rural and urban areas of Malir District.

Table 5.20: Working Population (%) by Employment Status in Rural and Urban Areas,[26]

Employment Status	All Areas			Rural			Urban		
	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female
Self Employed	33.35	33.73	24.78	37.80	38.39	27.68	31.46	31.79	22.97
Government Employee	12.92	12.59	20.45	16.58	16.92	10.83	11.37	10.78	26.44
Autonomous Employee	5.77	5.92	2.29	11.25	11.68	3.87	3.44	3.52	1.30

[26] District Census Report Malir, 1998

Employment Status	All Areas			Rural			Urban		
	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female
Private Employee	40.63	41.10	30.03	26.07	26.78	13.86	46.80	47.07	40.11
Employer	4.53	4.64	2.21	3.35	3.42	2.19	5.03	5.14	2.23
Unpaid-Family Helper	2.80	2.02	20.24	4.95	2.8	41.57	1.89	1.70	6.95

5.7.6 Industry

309. Malir and Korangi Districts are also known as a hub of the industrial sector as many large industries are established here which constitute about 15.3 percent of the entire Karachi Division. The type of industries that are commonly found here are of textiles, food, pharmaceuticals, iron, and ceramics. The famous one's are: (i) Daud Mills; (ii) Firdous Mills; (iii) Gul Ahmed Mills; (iv) Nagerya Mills; (v) Metropolitan Steel Mills; (vi) Pakistan Steel Mills and (vii) General Tyre and Trust Ceramic.

310. Malir is the most important center of handicrafts and cottage industries as well. Amongst others the main cottage industries are carpet, zari (gold/silver) and embroidery.

311. Bin Port Qasim is also situated in Malir District that is mainly used for bulk cargo and particularly serving for shipment of steel mills and other industrial products.

5.7.7 Public Health Infrastructure

a) Transportation

312. Coaches, buses, trucks, cars, motor bikes and Datsun pickups are most used by urban and rural masses of the district as a mode of transportation for mobilization purposes from one place to another.

b) Communication Facilities

313. People of Malir District like any other district of Karachi Division have access to telephone, mobile and internet facilities for communication and business purposes.

c) Water and Sanitation

314. Nearly 75.94 % of the population is using piped water, 2.46 % using hand pumps for potable water and 6.95% are using potable water taken out from wells. However, no proper and adequate water supply, sewerage and drainage facilities are available in district.

5.7.8 Land Use

315. The land use of the Project Area is a flat and barren land covered by urban settlements (residential, educational institutions and commercial areas), floral species (trees, flowering plants, grasses, and shrubs) and industries.

5.7.9 Power Source and Transmission

316. K-Electric (KE) (Karachi Electric Supply Corporation Limited) is a responsible authority for ensuring supply of electricity to rural and urban areas of Malir District. The main source of electricity generation in district are combined cycle power plants.

5.7.10 Agriculture

317. The predominant crops of Malir Green Belt are Lucerne (forage crop), vegetables (carrot, tomato, eggplant, okra, pumpkin, spinach, onion, chilies, tori and tinda) and fruits (guava, chikoo, mango, mulberry, papaya, date palm and bananas). Cultivation of food grain is very limited and is periodically substituted by most favored crops, vegetables, and fodder. Generally, the best lands are cultivated under vegetables, afterwards fodder and orchards. Multiple cropping is also common on most lands. **Table 5.21** shows area and production average yield of crops, fruits, and vegetables of Malir District.

Table 5.21: Area and Production Average Yield of Crops, Fruits and Vegetables[27]

Sr. No.	Crop	Area (Hectares)	Production (Tons)	Yield Per Hectare (Kilograms)
1.	Jowar (*Sorghum vulgare*)	629	261	415
2.	Wheat (*Triticum sativum*)	119	132	1,109
3.	Maize (*Zea mays*)	217	99	456
4.	Sesame (*Sesamum indicum*)	48	14	292
5.	Other Pulses	52	21	404
6.	Mango	1,625	2	1
7.	Papaya	350	175	500
8.	Coconut	60	42	700
9.	Chikoo	619	310	501
10.	Dates	8	2	250
11.	Guava	325	200	615
12.	Citaphul / Sharifa	123	12	98
13.	Carrot	1,200	180	150
14.	Tomato	625	37	59
15.	Egg Plant	250	45	180
16.	Okra	15	1	67
17.	Pumpkin	150	52	347
18.	Spinach	38	1	26
19.	Onion	121	48	397
20.	Chillies	60	2	33

[27] District Census Report Malir, 1998

Sr. No.	Crop	Area (Hectares)	Production (Tons)	Yield Per Hectare (Kilograms)
21.	Tori	250	50	200
22.	Tinda	37	07	189

5.7.11 Livestock

318. Farming, fishing, and livestock farming are still a way of living in rural areas of Malir. Due to handsome market demand for milk and milk products of the densely populated Karachi Division, livestock farming has developed remunerative enterprises and several livestock sheds locally described as bara in almost all the villages adjacent to and within Malir.

319. The Cattle colony situated in Malir District is considered as the largest dairy farm site within Sindh, where a good number of modern dairy farms are established. The site has been provided all describable and essential amenities including an animal husbandry hospital and breeding centre wherein all cattle are provided medical treatment as well as artificial insemination facilities. In addition to this, Hassan D-Silva Dairy Farm in Gadap Union Council is also very famous dairy farm of Malir District. **Table 5.22** shows number of livestock population in Malir District.

Table 5.22: Livestock Population[28]

Sr. No.	Livestock	Number of Animals
1.	Buffaloes	105,489
2.	Camels	2,324
3.	Cattles	97,303
4.	Ass	3,396
5.	Goats	243,957
6.	Horses	220
7.	Mules	255
8.	Sheep	27,173
9.	Domestic Poultry	134,119

5.7.12 Irrigation

320. The area's importance lies in the ground water resources which are sustained by the subterranean reservoirs. The Khadeji tributary of Malir provides perennial flow up to its confluence with Mol Nadi, but downstream of the confluence the water seeps into the alluvium and flows as a subterranean channel towards the sea. The water table at the riverbank lies at a depth of 18.21 meters which increases to 24.27 meters in the valley flanks away from the river. During dry years when recharge is negligible or drastically reduced the water table falls to 37.5 meters or more. This ground water reservoir is tapped by many hundreds of wells fitted with diesel or electricity operated pumps that irrigate about 11,000 acres. Because of shifts in channel flow and insufficient recharge,

[28] District Census Report Malir, 1998

many wells have gone dry or have insufficient water. As consequence of drying up of the wells about 3,000 acres of land have gone out of cultivation.

5.7.13 Forestry

321. The forest resources are very limited due to the arid conditions prevailing over Malir District. The forests in the district are often small and scattered. The forest on the banks of Malir, are mainly babul, kandi and lai and babul being most dominant species and economically most valuable. The dominant vegetation of the area consists of xerophytic shrubs and grasses which in some areas furnish good grazing grounds.

5.8 QUALITY OF LIFE VALUES

5.8.1 Religion

322. The population of the Malir District is dominantly Muslim who constitutes 96.57 percent of the total population, 96.51 percent in rural area and 96.60 percent in urban area. The remaining 3.43 percent population are Christians, Hindus and Qadyani (Ahmadi)[29].

5.8.2 Language

323. Sindhi as mother tongue is spoken by 25.08 percent of the total population in the district, followed by Pushto and Punjabi comprising 20.67 and 17.46 percent respectively. Other languages such as Urdu, Balochi and Saraiki are spoken by 15.87, 8.5 and 2.36[30] percent of the population. Brahvi and Hindko are some of the languages that are also spoken by the population of district for communication in household.

5.8.3 Ethnicity / Tribes

324. Malir is a multicultural district as different tribes / ethnic groups are settled here. The principal ethnic groups in the district are Sindhi, Pashtoon, Baloch, Memons, Punjabi, Bengalis, Burmese and Meghwars.

325. Among Sindhi, the tribes settled here are Syed, Jokhia, Khaskheli, Palari, Bareja, Bhabra, Dhars, Sirhindi, Jamot and Mohanas. These tribes are landowners who keep herds and do fishing.

326. Balochi tribes that reside in the district are Kulmati, Jadgal, Gorgej, Hoot, Vadela, Vashki, Zarzedagh, Tumpi, Laghari, Khosa, Rindh, Brohi and Harani (Kharani).

[29] District Census Report Malir, 1998
[30] District Census Report Malir, 1998

5.8.4 Public Health

327. In Malir District, there are numerous hospitals, clinics, and dispensaries well-equipped with modern technological equipment's needed for treatment of diseases. The brief detail of health facilities available in district on government level is given in **Table 5.23.**

Table 5.23: Government Health Facilities in Malir[31]

Sr. No.	Health Facilities	Total Number
1.	Basic Health Units	14
2.	T.B Clinics	4
3.	Dispensaries	7
4.	RH Centers	2
5.	MCHC	6
6.	Hospitals	1

328. Health Institutions that are present in and around the Project Area are RBT Eye Hospital, Al Saeed Medical Centre, New Revival Kainat Clinic Maternity Home, Bilquees Hospital, Indus Hospital, Meternity Homes Hospital, Darul Shifa (Khumeni) General Hospital, Al Tibri Medical College and Aslam Clinic.

5.8.5 Aesthetic Values and Recreational Resources

329. Arabian Country Club, Wateji AirField, and Fiesta Water Park are sources of attraction for local masses and tourists for recreational activities in and around the Project Area.

5.8.6 Religious, Archaeological or Historic Treasures

330. The religious, archaeological, or historic treasures that are of significance in Malir District are: District Headquarter Malir, Pakistan Steel Mills and Chowkwandi Tombs.

331. Shrine of Noor Shah Baba, Dargan Mai Niani, Dargah Shah Hussain, Dargah of Masoom Shah and ancient graves and exist in the Project Area as show in **Figure 5.13.**

5.9 SOCIOECONOMIC BASELINE SURVEY

332. The information regarding socioeconomic baseline survey is based on the primary data collected from the Project Area through field visit that was carried out. Baseline survey was carried out for:

- Informing the stakeholders about the proposed Project;
- Providing an opportunity to those involved with the planning of Project to ensure that the benefits of the proposal are maximized and that no major impacts have been overlooked;

[31] *District Census Report Malir, 1998 (Most of the information in census report of 2017 except population has not been published yet therefore information has been taken from the census report of 1998)*

- Providing an opportunity for the public to influence the Project design in a positive manner;
- Increasing public confidence in front of proponent, reviewers and decision makers;
- Providing better transparency and accountability in decision making;
- Reducing conflict through the early identification of contentious issues, and working through these to find acceptable solutions; and
- Creating a sense of ownership of the proposal in the minds of the stakeholders.

333. The information regarding socio-economic conditions is collected from primary and secondary sources. Methodology adopted for survey was based on collection of comprehensive information by utilization of all available resources with time effectiveness. Following methodology was opted for socio-economic survey impact assessment and development of baseline socio-economic conditions**.**

334. All available document related to socio-economic condition of the Project Area were studies i.e. (District Population Census Reports for the concerned districts, documents related to designs, maps for socio-economic survey. Meetings were held with the officials of relevant departments; feedback of all these meetings is also kept in view in study of socio-economic environment. Maximum information was utilized to complete the report.

335. Before conducting field survey, first a reconnaissance survey was conducted by the Consultant team of different categories. After familiarization of the area and requirement for the study a comprehensive survey was carried out and primary data was collected through following data collection tools:

    - Socio-economic Survey
    - Women Survey
    - Public Consultations
    - Gender Consultations

336. Moreover, extensive public consultations were conducted at different locations along the proposed route of the road and gender consultation were also done by female staff to get their apprehensions about the Project and their suggestions were recorded to improve the design of the Project. A sample of 240 respondents including (males and females) was taken from the different locations depending on the proportion of route of the proposed road passing in the areas based on random sampling technique, which included residents, farmers, shop keepers, pedestrians, drivers, hospital management, government employees, Imam Mosque etc. The objective of using the random sampling technique to get the data of the respondents of different categories along the alignment of the proposed road and covering the entire area. The purpose of this survey was to assess socio-economic condition of the area and get responses about the perceived impacts and preferences towards the Project implementation.

5.9.1 Survey Findings

337. Detailed findings of the survey comprising of different parameters are discussed in the following section.

5.9.1.1 Demographic Characteristic

338. Demography is defined as statistical analysis of data about the characteristics of a population, such as the age, sex / gender, religion, ethnic structures, mother tongue of the people within the population. According to survey, demographic characteristics of sampled population are described hereunder.

5.9.1.1.1 Gender Distribution of the Respondents

339. About 240 respondents, comprising 91% male and 09% female population in the Project was contacted to carry out socio-economic and impact assessment survey. Although only 09% female respondents' sample was not a sufficient representation in the study but due to law & order situation in Karachi it was difficult to have access to the females in households or females refused to provide such information. Even female enumerators were appointed for socioeconomic survey but due to uncertain law & order situation in the city females were reluctant in providing any information. **Table 5.24** shows gender distribution of the sampled respondents.

Table 5.24: Gender Ratio of the Respondents

Gender Distribution			
Sr. No.	**Sex Ratio**	**Number**	**Percentage (%)**
1	Male	218	91
2	Female	22	09
Total		**240**	**100**

340. The pie chart given below, (**Figure 5.19**) reflects the gender distribution of the respondents.

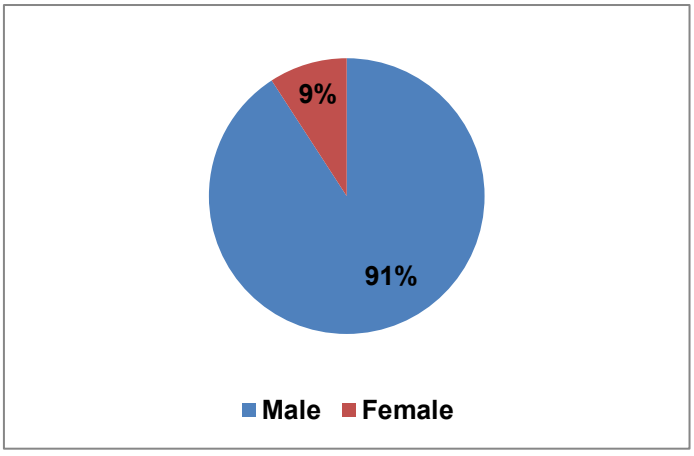


Figure 5.16: Gender Distribution

5.9.1.1.2 Population and Family Size

341. A socio-economic survey of 240 households was conducted as per methodology which indicated that the population of the surveyed households is about 1756 persons and among them, there were more males (52.6%) than females (47.4%). Around 36 percent of the household members are children (up to 10 years of age). The average family size is 7.3 persons per household and mostly people live in nuclear family system. The gender wise distribution of the 240 respondent's families is given in **Table 5.25.**

Table 5.25: Population and Family Size of the Respondents

Total Respondents	Population				Total Population	
	Male	%	Female	%		%
240	923	52.6	833	47.4	1756	100

Based on the social survey carried out in November 2020

342. The sex ratio is an important demographic indicator, which is defined as the "number of males per hundred females". As per social survey, sex ratio based on the household was 110 males per 100 females.

5.9.1.1.3 Age Composition

343. The demographic characteristics of the survey show **Table 5.26** that 13% of the respondents were 15 to 25 years of age. About 30% of the respondents were between the age group of 26 to 35 years and 36 to 45 years respectively. The remaining 27% were bearing up to 46 years of age and above of this age group. These age brackets of the respondents show that by and large respondents were mature enough to express their opinion/concerns about construction of proposed Project and foresee its impacts.

Table 5.26: Age Composition of the Respondents

Sr. No.	Age Composition	Number of Respondent	Percentage (%)
1	15[32] – 25	31	13
2	26 – 35	73	30
3	36 – 45	71	30
4	46 and above	65	27
Total		**240**[33]	**100**

[32] *According to the Constitution of Pakistan Article 11(3) no child below the age of 14 years shall be engaged in any factory or mine or any hazardous employment. During the socioeconomic survey, it was observed that many children above 14 and even younger were associated with different professions to earn for their families. The socioeconomic of above 14 were conducted to record their views.*

[33] *Respective analysis has been made on the data provided by the 240 respondents. It is important to mention here that most of the respondents were reluctant in providing the information of their families. Keeping in view, the available information it was more suitable to analyse and tabulated the data of the first hand respondents.*

344. The pie chart given below, (**Figure 5.20**) reflects the age composition of the respondents.

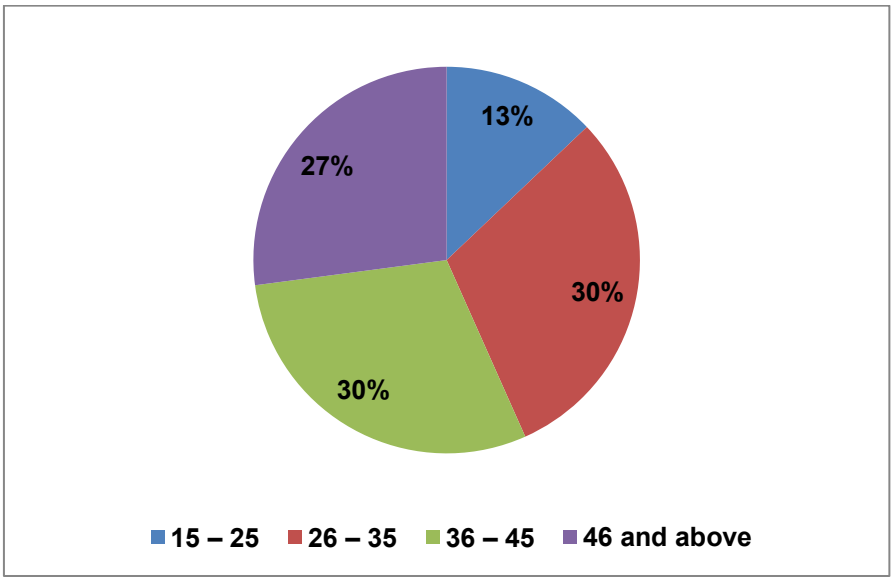


Figure 5.17: Age Composition

5.9.1.1.4 Educational Level

345. Educational distribution of the respondents is shown in **Table 5.27**. The data in the table presents that majority (53%) of the respondents had some sort of education. Moreover, 14% were educated up to primary level, 08% were with middle schooling, and 15% were matriculate. Whereas 08% respondents were reported themselves intermediate level. A very small number, i.e., 05% respondents were found graduates and masters and above for each level. The 02% of the respondents received religious education of Darse-e-Nazimi while the remaining 01% was those who can read only Quran. The graphical representation of educational status of Project people is depicted in **Figure 5.21** below:

Table 5.27: Educational Level of the Respondents

Sr. No.	Educational Level	Number of Respondent	Percentage
1	Illiterate	114	47
2	Primary	36	14
3	Middle	18	8
4	Matric	35	15
5	Intermediate	18	8
6	Graduation & Above	12	5
7	Darse-e-Nizami	4	2
8	Can read Quraan	3	1
Total		**240**	**100**

346. The pie chart given below shows the educational level of the respondents.

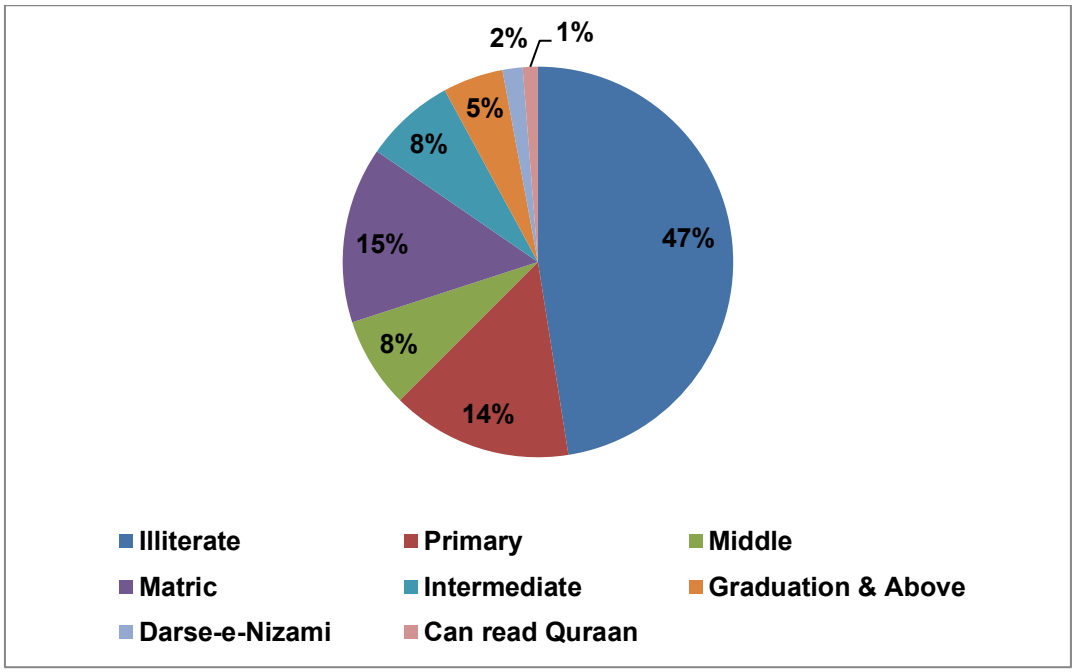


Figure 5.18: Percentage of Educational Level of the Respondents

5.9.1.1.5 Occupation

347. Socio-economic condition of the respondents was also studied during the field survey. Many (29%) of the respondents were doing different types of labor including agriculture, industrial and general labor for earning their livelihood, 05% running their own business or shops. While 03% reported themselves as mechanics and Government/Retired employees each. In the Project Area, farming is being done at small scale because the shortage of irrigation water in the area where only 02% of the respondents reported their profession as farming and 26% were drivers of buses, vans, auto, taxi, etc., Moreover, belonging to private service were twelve percent, 6% were running large scale business, 12% were housewives and remaining 2% were associated with hotel business. During survey, efforts were made to interact with the people representing all walks of life. The detailed statistics regarding occupational status of the respondents is presented in **Table 5.28** given below. **Figure 5.22** shows the graphical view of occupational status of the interviewed people in Project Area of influence

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Table 5.28: Occupation of the Respondents

Sr. No.	Profession	Number of Respondent	Percentage
1	Labor Workers	70	29
2	Shopkeepers/ Business	12	5
3	Mechanic	8	3
4	Govt. Employee/ Retired	6	3
5	Farmers	5	2
6	Driver	62	26
7	Private Service	29	12

Sr. No.	Profession	Number of Respondent	Percentage
8	Business	15	6
9	Housewives	21	9
10	Hotel	4	2
Total		**240**	**100**

348. The occupational distribution of the respondents is given below in the form of pie chart.

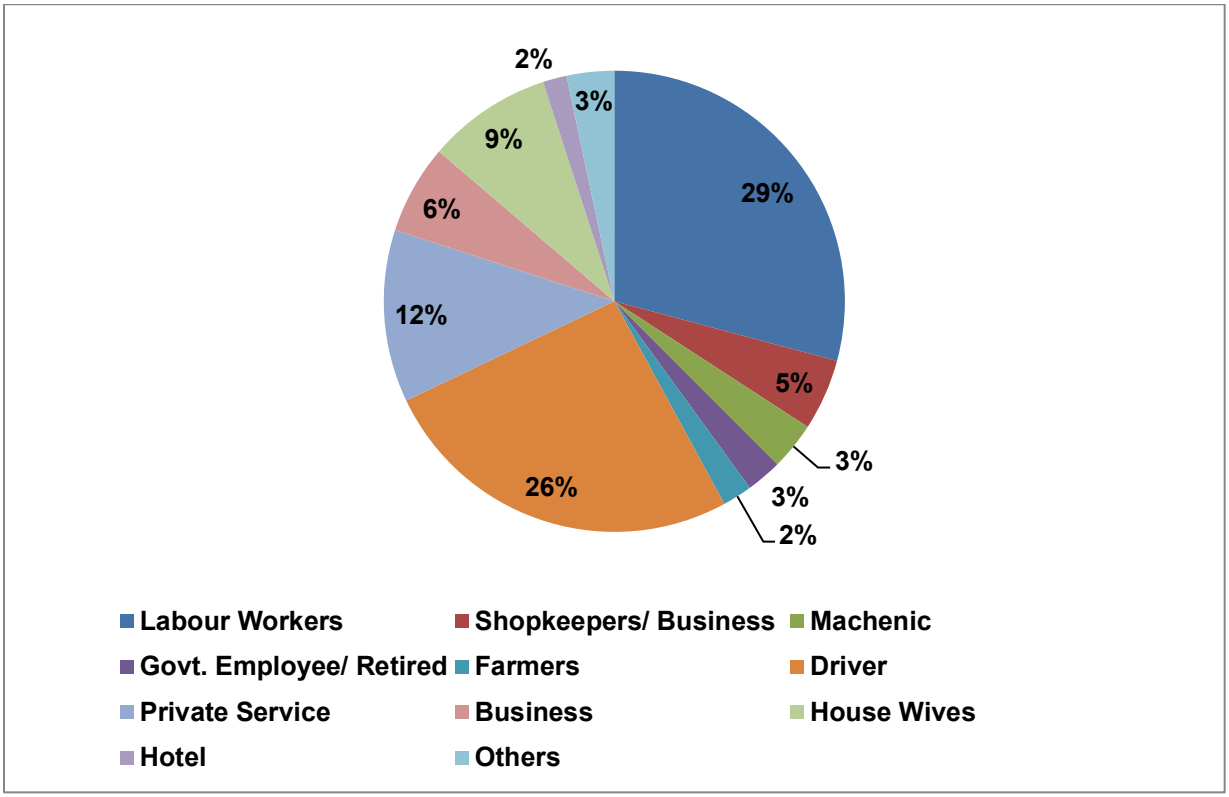

Figure 5.19: Occupational Distribution of the Respondents

5.9.1.1.6 Religion

349. Respondents were asked about their religion status during the survey and majority of the respondents' i.e., 97% of reported their religion as Islam while remaining three percent belongs to Hindu religion in the Project Area as shown in the **Table 5.29** and given in **Figure 5.23**.

Table 5.29: Religion of the Respondents

Sr. No.	Religion	Number of Respondent	Percentage
1	Muslim	232	97
2	Hindu	8	3
Total		**240**	**100**

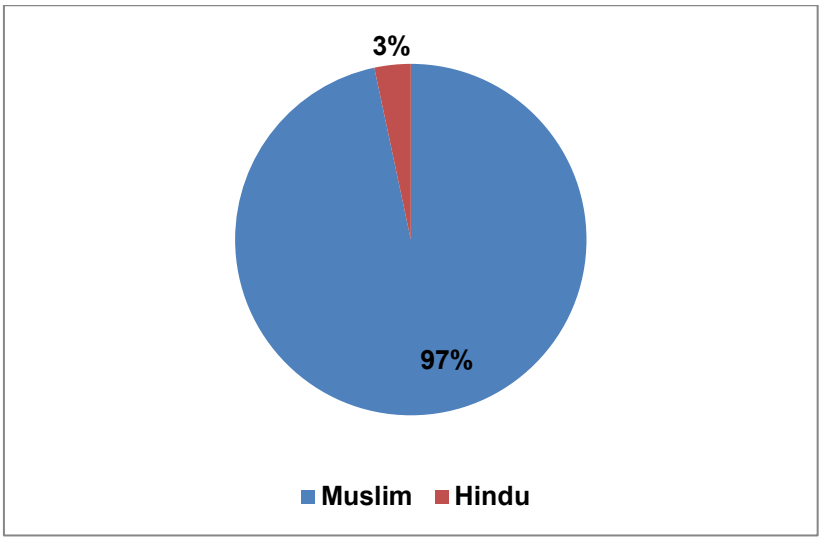

Figure 5.20: Religion of the Respondents

5.9.1.1.7 Ethnic Structure

350. There are various castes and sub castes in the area. The most common ethnic groups found in Project Area are presented in **Table 5.30.** The field data shows that majority of the respondents' i.e. 26% were Mallah while Magsi and Bloch were 15% and 12% respectively. Other than these castes Kathiawari & Syed were three percent each while Pathan & Abbassi were four percent and 33% belongs to some other castes (Awan, Jut, Gujjar and Arain) in the Project Area.

Table 5.30: Ethnic Structure of the Respondents

Sr. No.	Ethnic Group	Number of Respondent	Percentage
1	Mallah	63	26
2	Magsi	35	15
3	Bloch	28	12
4	Kathiawari	8	3
5	Pathan	10	4
6	Abbassi	9	4
7	Syed	8	3
8	Others	79	33
Total		**240**	**100**

351. The ethnic structure of the respondents is given below in the form of pie chart.

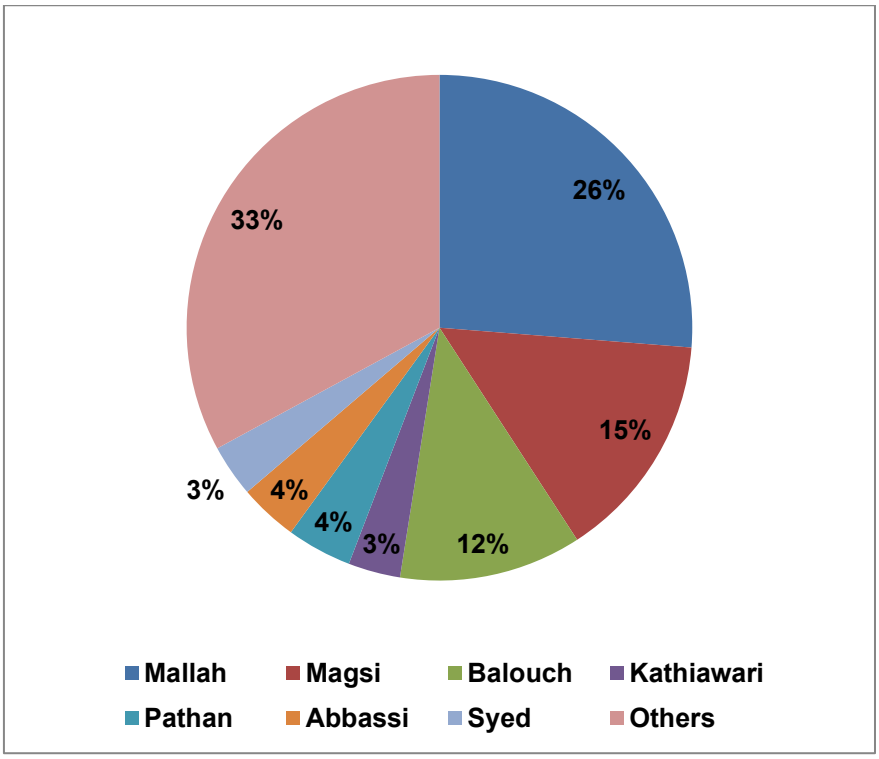

Figure 5.21: Ethnic Structure of the Respondents

5.9.1.1.8 Languages

352. In the Project Area, Sindhi is the dominant language being spoken by 32% respondents. It was reported that 30% of the respondents speak Balouchi, 28% Urdu speaking, and three percent were those who use Kathiawari language to communicate others. Remaining 7% respondents speak other different languages i.e., Punjabi and Saraki etc., as shown in Table **5.31** and are depicted in **Figure 5.25** below:

Table 5.31: Languages Spoken in Project Area

Sr. No.	Language	Number of Respondent	Percentage (%)
1	Balouchi	71	30
2	Sindhi	76	32
3	Urdu	68	28
4	Marwari	8	3
5	Others	17	7
Total		**240**	**100**

353. The pie chart given below shows the language spoken by the respondents in Project Area.

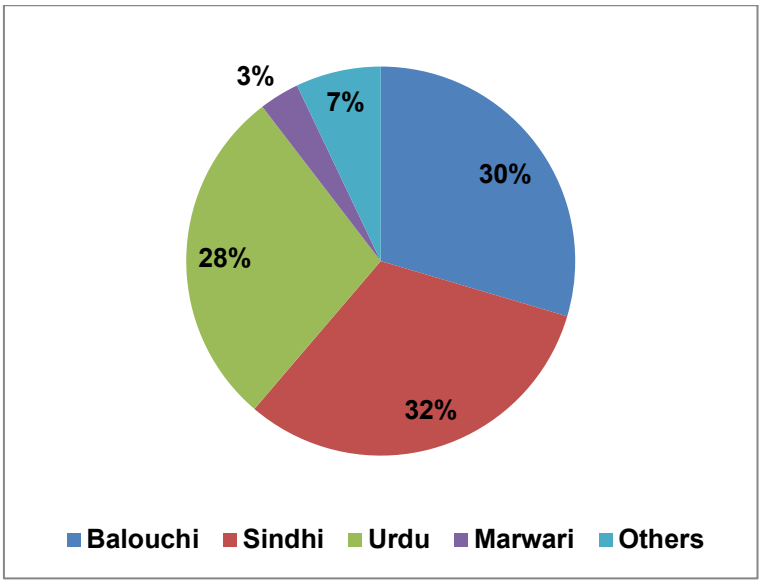

Figure 5.22: Language spoken by the Respondents

5.9.1.1.9 Family System

354. About 45% of the sampled population were living in joint family system where grandparents are also living under same roof and 55% percent respondents reported as nuclear family system. The detail is shown in **Table 5.32** below:

Table 5.32: Family Structure

Sr. No.	Family Structure	Number of Respondent	Percentage
1	Joint	107	45
2	Nuclear	133	55
Total		**240**	**100**

355. The pie chart given below shows the family structure of the respondents.

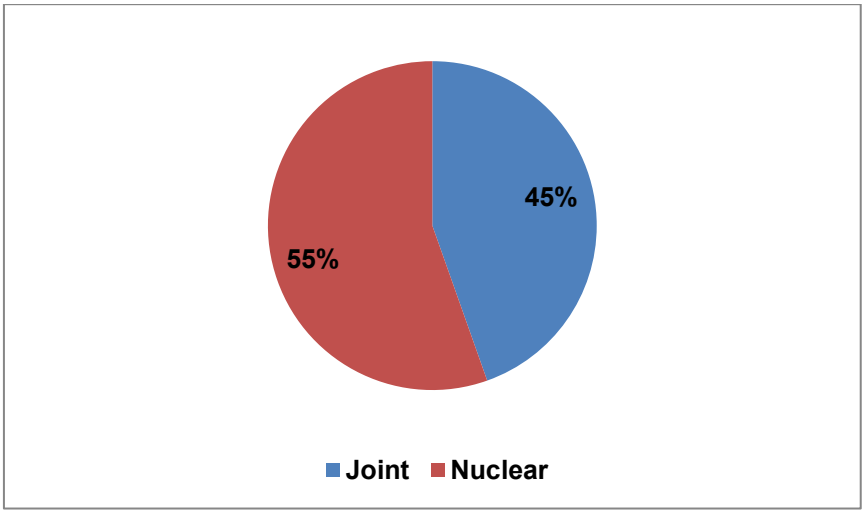

Figure 5.23: Family Structure of the Respondents

5.9.1.2 Socio- Economic Characteristics

5.9.1.2.1 Monthly Income of the Respondents

356. From **Table 5.33**, 16% of the respondents fall in the low-income group of up to rupees 17,500, 29% from the range 17,501 to 27,500 rupees, and 28% of the respondents were earning their monthly income between the ranges of 27,501 to 37,500 rupees per month. Whereas the income ranges of 37,501 to 47,500 reported by 11% and 16% were getting more than 47,500 per month.

Table 5.33: Average Monthly Income of the Respondents

Sr. No.	Average Monthly Income	Number of Respondent	Percentage (%)
1	Upto 17,500	38	16
2	17,501 – 27,500	70	29
3	27,501 – 37,500	66	28
4	37,501-47,500	27	11
5	Above 47,500	39	16
Total		**240**	**100**

357. In the pie chart the income groups of various respondents are shown below:

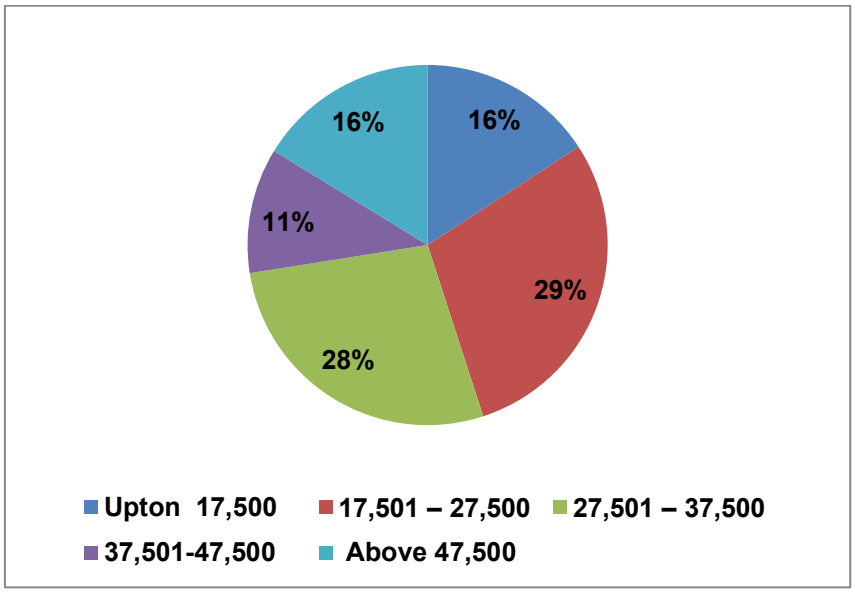

Figure 5.24: Average Monthly Income Level of the Respondents

5.9.1.2.2 Expenditure of the Respondents

358. Household expenditure depends on the earning and about 25% of respondents reported their monthly expenditure up to 17,500, and 42% respondents found within the range of 17,501- 27,500 per month. While 20 percent fall between the expenditure range of 27,501 to 37,500 and 5% recorded their monthly expenditures between the range of 37,501, 47,500 per month. While 8% of the respondents were having their expenses

more than 47,500 per month. The graphical view of average monthly expenditures is shown in **Figure 5.28** below:

Table 5.34: Range of Monthly Expenditures of the Respondents

Sr. No.	Average Monthly Expenditures	Number of Respondent	Percentage (%)
1	Up to 17,500	61	25
2	17,501 – 27,500	100	42
3	27,5001– 37,500	48	20
4	37,501-47,500	13	5
5	Above 47,500	18	8
Total		**240**	**100**

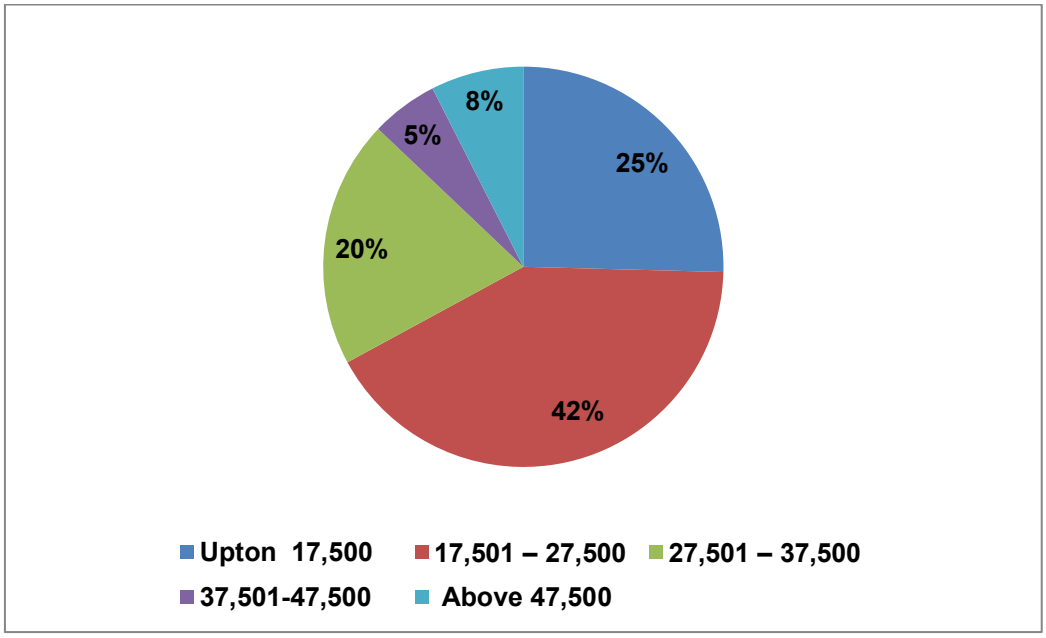

Figure 5.25: Range Monthly Expenditure of the Respondents.

5.9.1.2.3 Ownership Status of the Houses

359. Sampled respondents were asked about their housing ownership status in order to know their level of living standard as reflected in **Table 5.35**. Majority of respondents (i.e. 81%) were living in their own houses and 11% rented in their houses and remaining 8% were squatters.

Table 5.35: Ownership Status of Houses

Sr. No.	Ownership Status	Number of Respondent	Percentage
1	Owner	194	81
2	Rented	27	11
3	Squatters	19	8
Total		**240**	**100**

5.9.1.2.4 Housing Construction Pattern

360. A mix housing pattern has been observed in the Project Area where 50% of the respondents live in pacca houses that are constructed with superior materials and workmanship while 29% respondents have semi pacca houses that are houses made of bricks masonry with mud mortar. Only 18% of the respondents mentioned that they live in katcha houses made with mud and straws and reaming 2% have hut for their families to live. **Table 5.36** shows construction pattern of houses in Project Area.

Table 5.36: Housing Construction Pattern

Sr. No.	Type of House	Number of Respondent	Percentage
1	Pacca	121	50
2	Semi Pacca	70	29
3	Katcha	44	18
4	Hut House	5	2
Total		**240**	**100**

5.9.1.2.5 Landholding Status

361. Land ownership status of the respondents is given in **Table 5.37** that depicts that only 5% respondents were those who were holding their farmlands. Contrary to this, 95% sampled respondents were landless. **Figure 5.29** shows graphical view of land holding status of respondents in Project Area.

Table 5.37: Land Holding Status

Sr. No.	Land Holding	Number of Respondent	Percentage
1	Yes	11	5
2	No	229	95
Total		**240**	**100**

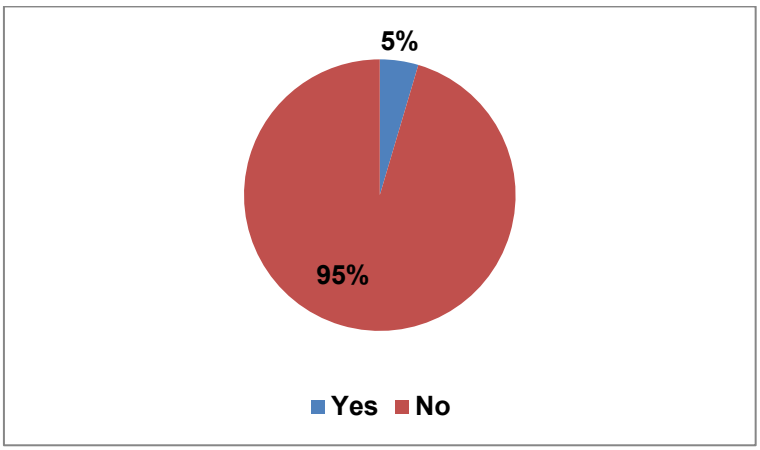

Figure 5.26: Land Holding Status

5.9.1.2.6 Borrowing Status

362. There are two types of credit sources available to the people, institutional and non-institutional. The survey in the Project Area revealed that only 4 percent sampled household's availed credit from bank and relatives. The loan was obtained for marriages and household expenditure. **Table 5.38** shows the borrowing status of the respondents as depicted in **Figure 5.30.**

Table 5.38: Borrowing Status of the Respondents

Sr. No.	Borrowing Status	Number	Percentage (%)
1	Yes.	10	4
2	No.	230	96
Total		**240**	**100**

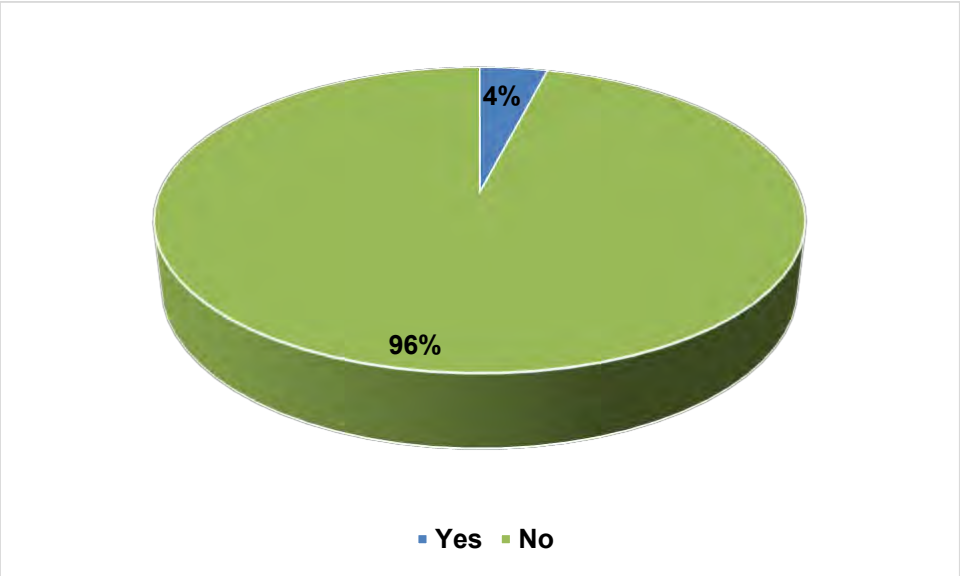

Figure 5.27: Borrowing Status

5.9.1.2.7 Mode of Transport

363. **Table 5.39** describes the mode of transport being used by the respondents sampled during social impact assessment survey. The facility of public transport in the Project Area is infrequent, therefore, about 53% of respondents reported using their own private transport and only 29 % of the respondents were using public transport. While, 18% respondents were enjoying both mode of transport, including public and private for travel purpose. Data is also depicted in the **Figure 5.31.**

Table 5.39: Mode of Transport

Mode of Transport	Number of Respondents	Percentage (%)
Personal	130	53
Public	69	29

Mode of Transport	Number of Respondents	Percentage (%)
Public & Person (both)	41	18
Total	**240**	**100**

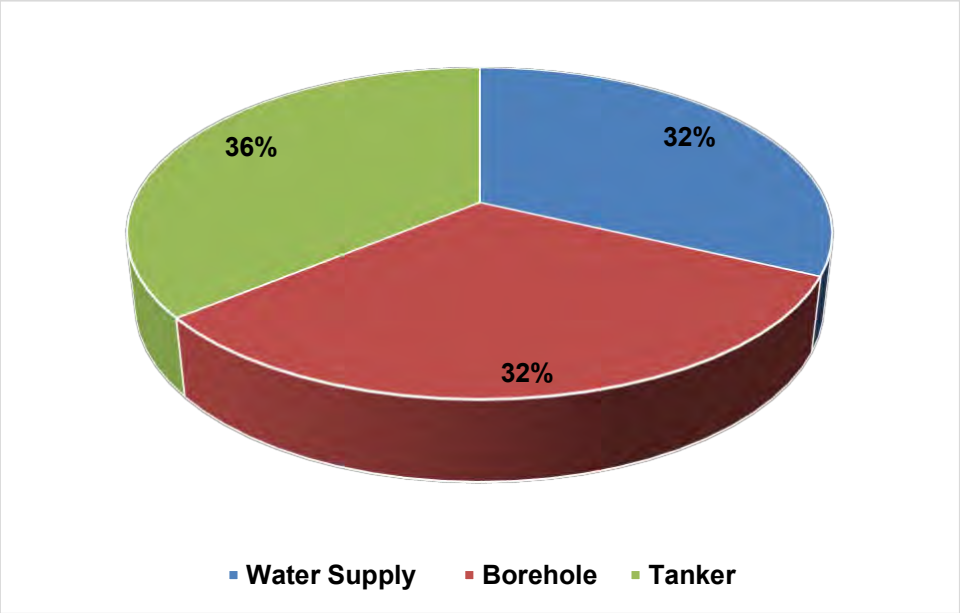

Figure 5.28: Mode of Transport of Households

5.9.1.3 Civic Amenities

5.9.1.3.1 Basic Amenities in the Project Area

364. Social infrastructure and amenities are crucial to creating sustainable communities. This assessment sets spaciousness of a household's dwelling, household amenities like availability of electricity and modern appliances, nature of access to water, fuel for cooking (ease of fetching in what are primarily women's tasks), and type of sanitation facilities available as primary indicators for assessing standard of living.

365. The result of the survey revealed that 93% of the households had electricity facility, water supply was available for the 84% of the sampled households, while the health care facilities were mentioned by 62% of the surveyed population. Providing basic level of education is the responsibility of the government, but the Project area is lacking this facility. Facility of Sui gas was available to 70% of the respondents in the Project corridor. The Poor sewerage system was mentioned by the respondents, where only 43% of the respondents, mostly living in the city area, mentioned this facility in their area. Mobile service is available in the Project area and its surroundings at a satisfactory level. The information with respect to access to social amenities and their quality of services is given in **Table 5.40.**

Table 5.40: Access to Social Amenities in the Project Area

Sr. No.	Social Amenities	Number of Respondents	Available (%)
1	Electricity	224	93
2	Water Supply	201	84
3	Health Facilities	149	62
4	School	148	62
5	Mettle Road	228	95
6	Mobile Service	240	100
7	Sewerage	104	43
8	Sui Gas	167	70

Source: field survey

366. Mostly educational and health facilities area amiable in the city where people of the surrounding areas avail these facilities.

5.9.1.3.2 Source of Drinking Water in the Project Area

367. Access to safe drinking water supply is not only a basic need and a precondition for healthy life but is also a basic human right. The quality of water is directly linked to the quality of health. Drinking water is not available inadequate quantity for human and livestock population as the ground water in the area is brackish. There are different sources of the drinking water in the Project area.

368. **Table 5.41** shows the source of water for domestic usage. The findings of the impact study indicate that (32%) of the respondents have the facility of line water supply, whereas ground water (tube-wells/hand pumps) was the source of drinking water for 32% of the sampled household and 36% of the households purchase water through tankers.

Table 5.41: Sources of Drinking Water

Sr. No.	Source of Water	Number of Respondent	Percentage
2	Water Supply	77	32
3	Borehole	77	32
4	Tanker	86	36
Total		**240**	**100**

369. In the pie chart (**Figure 5.32**), sources of domestic water have been shown below:

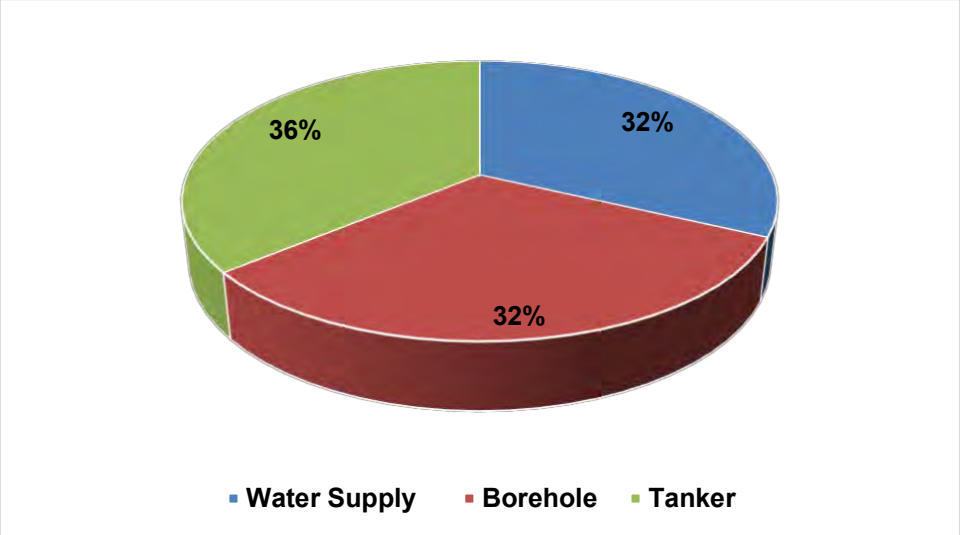

Figure 5.29: Sources of Drinking Water in the Project Area

5.9.1.3.3 Satisfaction about Quality of Water

370. **Table 5.42** shows the current situation of the water quality in the Project Area. Majority of the respondents (52%) were satisfied with the quality of water available in the Project Area, while 48% respondents were unhappy with the quality of water. The reasons for showing dissatisfaction are brackish and contaminated ground water.

Table 5.42: Satisfaction about Quality of Water

Sr. No.	Satisfaction about Quality of Water	Number of Respondent	Percentage
1	Yes	124	52
2	No	116	48
Total		**240**	**100**

371. In the pie chart (**Figure 5.33**), the satisfaction about quality of water is shown below

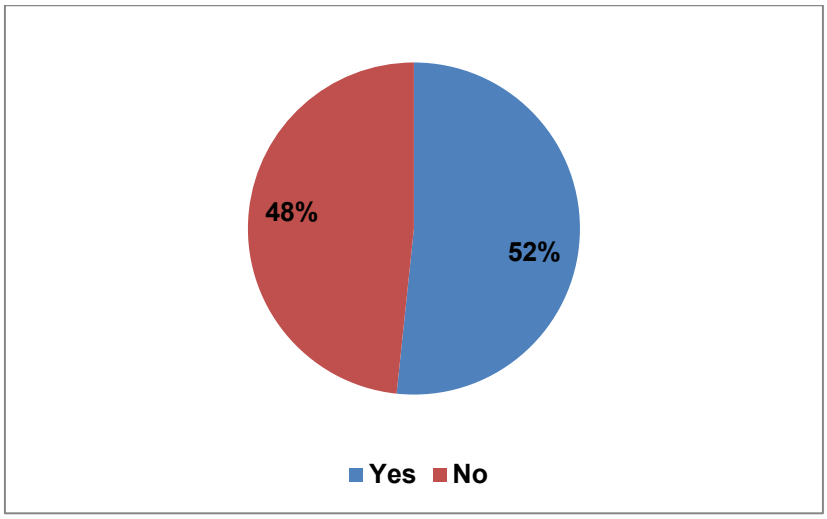

Figure 5.30: Level of Satisfaction with Quality of Water

5.9.1.4 Cultural Sites

5.9.1.4.1 Mosques and Shrines

372. Survey finding shows the presence of religious property (mosques and shrines) near the Project Area. During the survey it was observed that mosques are available in almost all large and small settlements of the Project Area. Shrine of Noor Shah Baba, Dargan Mai Niani, Dargah Shah Hussain, Dargah of Masoom Shah and ancient graves exist near the Project Area.

5.9.1.5 Mechanism of Conflict Resolution

373. During the field survey, discussions were held with the local communities, and it was observed that most of activities are carried out under the instruction of the head of a caste. The decisions about conflicts, right to vote, marriage settlement and other matters are usually resolved in the police station in some cases resolved by the head of tribes. Most of the conflicts in the Project Area are insignificant, i.e., theft of motorcycles or quarrels among youngsters which are mutually resolved within the caste at local level. Sometimes, the conflicts not resolved by the parties are referred to the police or court.

5.9.1.6 Common Diseases in the Project Area

374. The climate of the sub-Project area is typically arid and characterized by low rainfall. Moreover, there is less vegetation cover and no fresh ground water. The ground water is brackish and contaminated which is not fit for drinking purpose in most part of the Project Area. During the survey, diarrhea, pain in joints, hepatitis, and diabetes were the most pointed out diseases. The Medical Officer (MO) of the Indus Hospital was also consulted during the survey to discuss diseases in the Project Area mentioned by the community.

5.9.1.7 Source of Irrigation Water

375. Cultivation of land in the Project Area is traditionally done through rainwater and the lifting of water through wells and Malir River. Some farmers have also installed tube-wells to irrigate their land to produce different types of the crops.

5.9.1.8 Cropping Pattern

376. The survey indicates that crops sown in the Project Area during both seasons are wheat, cotton, and different types of vegetables. Different types of orchards also exist in the Project Area.

5.9.1.9 Awareness Regarding the Proposed Project

377. Many respondents (94%) were those, who had prior knowledge of the Project. Only 6% were unaware about the Project as shown below in **Table 5.43.** All respondents were briefed about the features of the proposed Project.

Table 5.43: Awareness about the Project

Sr. No.	Awareness of the Project	Number of Respondent	Percentage
1	Yes	226	94
2	No	14	06
Total		**240**	**100**

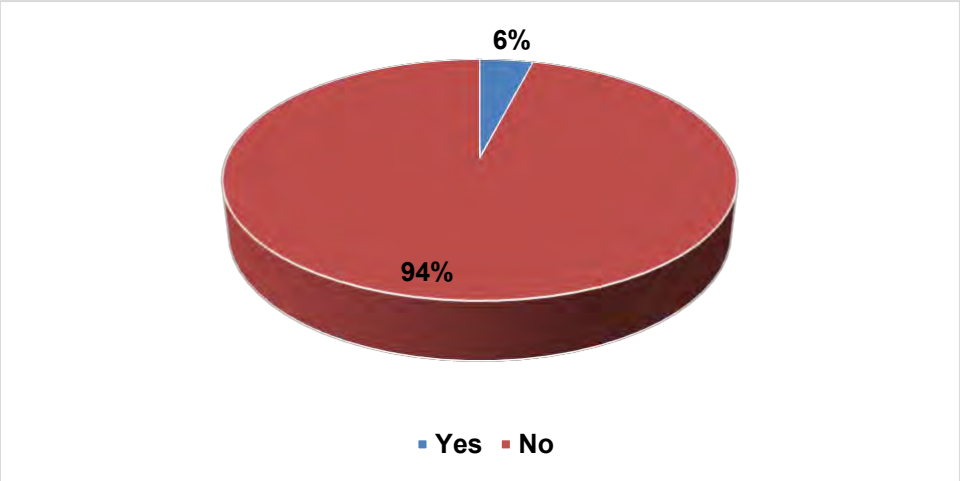

Figure 5.31: Graphical View of Awareness of Project

5.9.1.10 Acceptability of the Proposed Project

378. During the survey, majority (94%) of respondents favored the construction of the Malir Expressway Project keeping in view its importance and need. The reason for accepting the proposed Project is accidents on the existing road due to the heavy traffic and thus

local people consider construction of new road will reduce accidents. The smooth flow of traffic is expected due to implementation of the Project. Contrary to this, only 6% responses were against the construction of the proposed Project due to loss of their property, agricultural land, religious, government structures and movement of heavy traffic near the residential areas. (**Table 5.44**).

Table 5.44: Acceptability of the Proposed Project

Sr. No.	Frequency of Project Acceptability	Number of Respondent	Percentage
1	Yes	225	94
2	No	15	06
Total		**240**	**100**

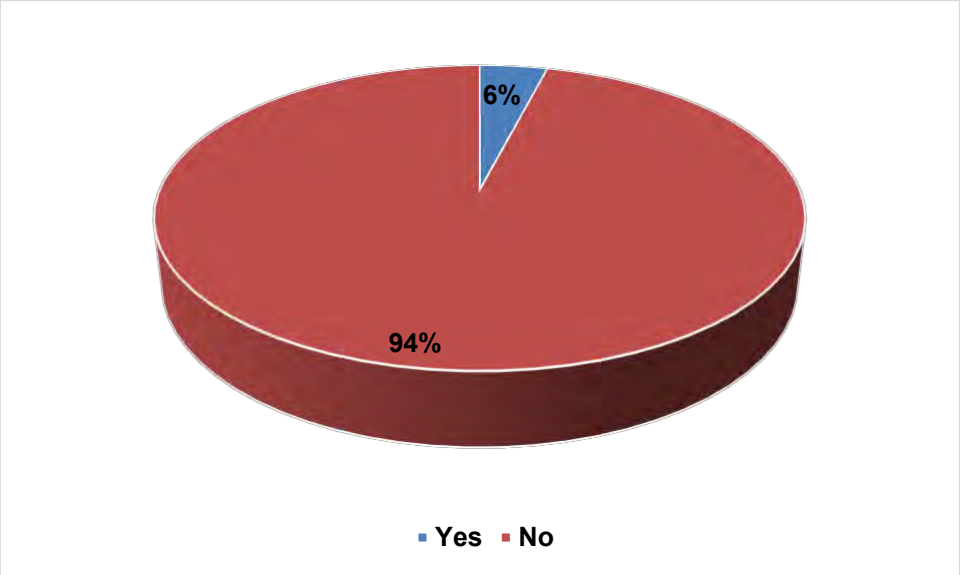

Figure 5.32: Graphical View of Project Acceptability

5.9.1.11 Gender Aspects

379. Out of the female respondents, only one respondent was working to support her family. Other female respondents were indulged in domestic work. As per information provided by these female respondents, in the Project Area, women were participating in various income generating activities such as crop production, post-harvest activities, poultry rearing, management of livestock. A small number of women also work in industrial units of Karachi city to supplement their household income. Women of the Project Area also serve in education and health sectors. However, the actual figure of working women was not available with these respondents.

380. Rural women are major contributors in many sub-sectors of the rural economy, i.e. crop production, livestock production, cottage industry, household and family maintenance activities, such as transporting water, fuel and fodder to and from the home, food preparation and preservation and caring for children. The women have no recognized

role in the authority structure of the villages despite representing about 46.5% of the population of the Malir District and 47.7% of the Korangi district.

5.9.1.11.1 Women Participation

381. Women have a vital role in maintaining domestic functions. During the field survey, the role of the respondents about their participation in different activities of daily life was inquired. The information on gender was also collected through individual interviews and group discussions with female respondents by the gender enumerators.

382. The findings of the survey revealed that participation of women in various household activities in the Project Area. The 93% of women participation household activates and 92% in childcaring. Women of the area help their male family member in income generation activities and their participation in implementation and participation in the livestock and farming is only 1% and 4% respectively. **Table 5.45** indicates the women participation level.

Table 5.45: Women Participation in the Various Activities

Sr. No.	Activities	Participation Level
1	Household	93%
2	Child caring	92%
3	Livestock	1%
4	Farming	4%
5	Employment	5%
7	Social obligations (marriage, birthday& other functions)	100%
8	Local representation (counselor /political gathering)	0%

Source: Field Survey

5.9.1.11.2 Women Issues

383. During the survey, the issues related to the women highlighted by the respondents which are prioritized are as under:

- Limited access to and control over benefits
- Public transport service
- Availability of drinking water
- Access to medical treatment
- Access to educational institution
- Skill development
- Toilet facilities
- Women empowerment and participation

5.9.1.12 Presence of Indigenous People (IPs)

384. Indigenous peoples are peoples defined in international or national legislation as having a set of specific rights based on their historical ties to a particular territory, and their cultural or historical distinctiveness from other populations that are often politically dominant. The survey finding shows that no IP groups were found / reported in the Project corridor.

5.9.1.13 Pressing Needs of the Area

385. Water scarcity is a human-made phenomenon, where the inexorable rise in demand for water to grow agriculture, food, supply industries and sustain urban and rural populations has led to a growing scarcity of freshwater in many parts of the world. Pakistan and specially Sindh faces one of the worst situations of water quality due to poor water governance. Most of the residents in the Project Area are facing problems of clean drinking water, uncontrolled sewerage, shortage of medical facilities and schools. Facility of sui gas is also not available for the majority. Mostly people in the Project Area get water for drinking and domestic use through tube-wells. Underground water has turned contaminated due to many reasons.

386. The use of poor water quality causes several environmental health related problems and several diseases related to renal complexities, skin allergies, reproductive, blood disorders and carcinogenic problems. During the survey most pressing need voiced by the respondents both males and females was the provision of clean drinking water (water filtration plants) in the area. The local people also demanded the supply of clean drinking water (filtration plants), sui gas, and medical facilities in the area. Employment in different sectors was also expressed by the people of the Project Area.

Climate Vulnerability (Flooding due to Heavy Rains)

387. In the past many years, Karachi has been facing severe problems due to heavy rains in the monsoon season as there are serious issues with the drainage system in Karachi. Despite accepting the factual reality of the situation, one cannot blame any institution but the responsibility lied with the Provincial government, the Karachi Metropolitan Corporation (KMC), and District Municipal Corporations (DMCs) to keep clean the drains of Karachi and to drain out all the rainwater from the city.

388. There was a natural drainage system comprising many natural Nullahs in Karachi through which rainwater and drainage water would flow out into the Lyari and Malir River. Ultimately, rainwater and the open drains of many residential areas or settlements through these two main drains fall out into the sea. But unfortunately, almost all natural drains and nullahs are encroached on a large-scale throughout the city.

389. To avoid the occurrence of a catastrophe of this scale in the future as during the heavy rains in 2020, it is necessary for a new, comprehensive, and integrated storm water drainage system for the city. In addition, the restoration, and rehabilitation of 36 large

drain nullahs of the city, including relocations of encroached housing settlements and other constructions, is also required alongside maintaining them by avoiding dumping of garbage around into these drains.

6 STAKEHOLDER CONSULTATIONS

6.1 GENERAL

390. Timely and broad-based stakeholder involvement is an essential element for an effective environmental assessment, as it is linked with Project Planning, appraisal, and development in general. Public involvement during Environmental Impact Assessments (EIA) tends to improve Project design, overall environmental soundness, and social acceptability.

391. Public involvement, undertaken in a positive manner and supported by a real desire to use the information gained to improve the Project design, will lead to better outcomes, and lay the basis for on-going positive relationships between the project executors and the stakeholders. It gives the feeling of an ownership to the local population. Public involvement is necessary for smooth implementation of the Project and especially the local community whose support is also required for the success of the Project.

392. The Project management and implementation authorities are committed for undertaking public consultation at Provincial and local levels as a part of Project planning/design for getting necessary environmental permissions.

393. This Chapter presents the objectives, process, and outcome of the consultations carried out with the key stakeholders of the Project during the present EIA study. A consultation framework, describing the consultations to be carried out during the subsequent phases of the Project implementation ensuring ongoing and inclusive dialogues with key stakeholder is also provided in this chapter.

6.2 OBJECTIVE

394. The objectives of stakeholder consultation were to contribute to openness, transparency, and dialogue around the project. Special efforts were made to ensure that the communication with the public should be efficient and well balanced. The concerned stakeholder groups were identified to participate in the assessment process. Specific tasks and purposes of consultations with stakeholders have been given in the **Table 6.1.**

Table 6.1: Tasks and Purposes of Consultations

Task	Purpose of Consultation with Stakeholders
Why consultation with the stakeholders?	• To build trust to ensure sustained support for the Malir Express Way Project • To learn about public concerns that need to be addressed and considered in designing of the Project concept and preparing mitigation measures • To learn about the strengths, skills, and organizations that the stakeholders can bring to support Project planning and implementation.
Modes and benefits of consultation	• Dialogue with stakeholders to keep the Project in line with public concerns early • Engaging the public as advocates for the Project construction and to support the implementation of social, resettlement, and environment and health programs.

395. Other objectives of public involvement include:

- Informing the stakeholders about the proposed Project;
- Providing an opportunity to those who remained unable to present their views and values, therefore allowing more sensitive consideration of mitigation measures and trade-offs;
- Providing those involved with planning the proposal with an opportunity to ensure that the benefits of the proposal are maximized and that no major impacts have been overlooked;
- Providing an opportunity for the public to influence the Project design in a positive manner;
- Increasing public confidence in front of proponent, reviewers and decision makers;
- Providing better transparency and accountability in decision making;
- Reducing conflict through the early identification of contentious issues, and working through these to find acceptable solutions;
- Creating a sense of ownership of the proposal in the minds of the stakeholders; and
- Developing the Project which is truly sustainable.

6.3 IDENTIFICATION AND CATEGORIZATION OF STAKEHOLDERS

396. Identification of stakeholders is an important step which ensures that all the concerned stakeholders are identified for the following:

- Sharing of information with stakeholders about the proposed Project activities and potential impacts of proposed Project on the physical, ecological, and socio-economic conditions in the CoI; and
- To address the most relevant concerns of the stakeholders on Project and its activities including the upfront negative impacts.

6.3.1 Primary Stakeholders

397. Primary stakeholders are those who are directly concerned with the Project or directly affected both positively and negatively by the Project interventions. The primary stakeholders of this Project include Project owner, and the Project Affected Persons (PAPs). Apart from this, the beneficiaries of the Project and the implementing agency are also primary stakeholders for the proposed Project.

6.3.2 Secondary Stakeholders

398. Secondary stakeholders are people or groups that are indirectly affected from the Project activities or have their interest in the proposed Project such as SEPA, Agriculture Department, Forest Department, Wildlife Department, Irrigation Department, Revenue Department, Karachi Metropolitan Cooperation (KMC) and other various line agencies / departments of GoS.

399. Details regarding roles and responsibilities of the concerned agencies and departments are given below **Table 6.2**.

Table 6.2: Role of Concerned Agencies/Departments

Project Stakeholders	Roles and Responsibilities
Sindh Environmental Protection Agency	• SEPA is a regulatory authority and mainly responsible for the development and implementation of the environmental policies and strategies in order to integrate environmental issues and sustainable development approaches into the legal and regulatory frameworks as per Sindh Environmental Protection Act, 2014. • EPAs are responsible for the issuance of NOC of the Proposed Project. • EPA Sindh is responsible for the compliance of EMMP and NOC provision during the construction and operation stages of the Project.
Agriculture Department	• Ensuring food security • Enhancing productivity through better varieties and improved management practices • Promoting high value crops, fruits, and vegetables • Promoting export of high value agricultural products • Promoting efficient use of water and other inputs • Improving soil health • Development of culturable waste lands • Ensuring fair returns for the growers in marketing of their produce
Forest Department	• Protection, improvement, and maintenance of existing forests • Increase forests by planting new trees • Extension and advisory services to the public about tree plantation
Wildlife Department	• To save and protect wildlife
Fisheries Department	• Conservation of fisheries reservoirs • Management and development of resources on scientific lines • Extension of services to private sector
Revenue Department	• Provide land ownership data of District Populations which include but are not limited to the ownership record, land categorization and price details. • Responsible for implementation of all relevant Sections of LAA, 1894.
Karachi Metropolitan Corporation (KMC)	• Planning development and maintenance of Karachi roads, bridges, streetlights, storm water drains, land control/ removal of encroachment, solid waste management, municipal watch and ward, firefighting, traffic engineering, charged parking, etc.
Karachi Water and Sewerage Board (KWSB)	• Undertake bulk production, filtration / treatment transmission and retail distribution purifying of water. • Undertake collection, pumping, treatment & disposal of sewage & industrial waste. • Billing and collection of water & sewerage charges including arrears thereof.
Works and Services Department (GoS)	• This Department is responsible for planning, execution, development and maintenance of all Provincial Roads and Bridges through Annual Development Programme, and foreign assistance. • To serve the wider public, in line with the policy of the Government of Sindh, by designing, constructing, and maintaining roads, bridges and buildings, in the fairest, just, and most equitable manner possible to ensure optimal development for all people living in the province. • Management of Technical and Financial Affairs related to all schemes undertaken by various attached department of W&S Department. • Control of Administrative matters including organizational affairs, logistics and human resource management.

400. Considering the importance of the Project, consultations were carried out at all possible levels i.e., departmental and local levels. The process of consultation is an on-going

process which continues during the Project life cycle and even after the submission of this report and so on. Stakeholders were identified, categorized, and consulted at the Departments and Communities level.

401. During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. Key stakeholders of the Project include government departments such as the Sindh Environmental Protection Agency, Agriculture Department, Highway Department, Local Government Department, Government of Sindh Department, Forest Department, Wildlife Department, Fisheries Department, Revenue Department, Irrigation Department, local communities, and Project Affected Person. Non-Governmental Organizations (NGOs) working in the area on the same nature of projects, Community Based Organization (CBOs) were also consulted.

6.4 CONSULTATIONS

402. A series of public consultations were required to get the feedback/concerns of the different category of stakeholders including provincial departments, district level departments, potential PAPs, local community, and other public residing in the Study Area.

403. The consultation process includes focus group discussions, village/Town meetings and semi-structured interviews and one to one meeting or interviews with the government, private and civil society institutions. During the consultation process, the stakeholders were briefed about the Project objectives and scope. Their fears and suggestions were recorded.

404. Consultations were conducted at two levels:

- Institutions/Departments Level
- Community level

6.4.1 Consultations with Stakeholders at Departments Level

405. The stakeholder consultation was held with relevant departmental personnel. Details of department officials contacted are given in **Table 6.3.**

Table 6.3: List of Government Officials Consulted

Sr. No.	Name of Person	Designation	Name of Department/ Office
1.	Mr. M. Sajjad Hussain Gilal Irfan Rafi Hashmi Zain Fawzi	Director Technical Assistant Director Director Finance	Public-Private Partnership Unit/ Sindh Finance Department
2.	Mr. Javed Meher	Conservator Wildlife	Sindh Wildlife Department
3.	Mr. Maqsood Memon	DFO Karachi	Sindh Forest Department

Sr. No.	Name of Person	Designation	Name of Department/ Office
4.	Muhammad Ishaq	Survey Superintendent Karachi	Revenue Department (Survey Section)
5.	Mr. M. Sajjad Hussain Gilal Irfan Rafi Hashmi Shahzad Hasan Rizvi Haroon Munawar Zain Fawazi	Director Technical (PPPU) Environment Specialist (PSF) Social Development Specialist PSF Assistant Director (Technical-PPPU) Director Finance PPPU	Public-Private Partnership Unit (PPP) and PPP Support Facility (PSF)
6.	Mss. Hamad Siddique Saeeda Fatima	Deputy Director Deputy Director	Social Welfare Department (Malir and Korangi Districts)
7.	Jawed Nabi Ahmed	Head Administrator	Iqra University
8.	Dr. Abubakar Balouch. Syed. M. Haider	Assistant Professor Director Physical Education	Govt. Degree College (Murad Memon Goth, Malir)
9.	Ms. Mehwish	Administrator	Indus Hospital
10.	Ms. Safia Khan	President	Eman Welfare Association
11.	Mr. Akhtar Hussain	Center In charge	ZMT Clinic
12.	Rizwan Ali Abbasi	Superintendent	Revenue Department (DC Office Malir District)
13.	Mr.Shabir	Assistant District Officer	Malir Bund Division
14.	Amir Mohammad & Qadir Buksh Charan	Assistant Director Fisheries	Office of Director Marine Fisheries, Fisheries Department, Govt. of Sindh
15.	Rana Mohammad Iqbal Mansoor Zafar	Deputy Director Fisheries (Headquarter) Deputy Director Fisheries, Huxbey Marine Fish Hatchery	Office of Director General Marine Fisheries, Fisheries Department, Govt. of Sindh
16.	Syed Mohammad Taha	Special Secretary (Tech)	Local Government
17.	Mr. Jamaluddin Mangan	Special secretary (Tech)	Irrigation Department
18.	Ms Farzana Naseem	Assistant Director (tech)	Sindh EPA
19.	Mr. Azeem Khan	General Manager P&D	Sui Southern Gas Company (SSGC)
20.	Mr. Nek Muhammad	Executive Engineer	National Transmission & Dispatch Company (NTDC)
21.	Mr. Ghulam Haider & Ms. Shama Parveen	Assistant Chief Development	Works & Services Department, GoS

Sr. No.	Name of Person	Designation	Name of Department/ Office
22.	Mr. Muhammad Riaz	Superintending Engineer Bulk Transmission	Karachi Water & Sewerage Board (KW&SB)
23.	Lieutenant Abubakar Captain Naeem Akram Captain Anis	Squadron Leader Commandant Admin Land Record Official	Office of Faisal Air Base, Pakistan Air Force, Karachi
24.	Lieutenant Umar Lieutenant General Ali Naqvi	Representative Official NPV, PNS Nigran SSO Mehran Air Base	Office of Naval Provost Marshal, PNS Mehran, Karachi
25.	Mr. Nemat Ullah	Section Officer Crop Reporting	Agriculture Department
26.	Mr. Gul Junaijo	DFO Social Forestry	Forest Department
27.	Mumtaz Ali Summro	Assistant Conservator Admin	Wildlife Department
28.	Mr. Zahid Hussain Shar	Director Operational	Provincial Disaster Management Authority, GoS

406. The **Table 6.4** indicates the detail of issues raised/discussed and suggestions given during the consultation:

Table 6.4: Detail of Issues/Points Raised/Discussed during Departmental Consultations

Sr. No.	Department/ Organization	Suggestions
1.	Revenue Department (Survey Section)	• The official explained about the status notification and implementation of section 4 of land acquisition act 1894.
2.	Social Welfare Department (Malir and Korangi Districts)	• Facilities of toilet for the passengers should be provided. (Rest stops) • At Bus Stop Waiting room for passengers should be constructed. • Maximum skilled & unskilled labor should be hired from the local community during the Project construction activities. • Occupational health and safety should be taken care during construction of the road • Physical disturbance should be avoided. • Livelihood disturbance should minimized • During the construction period safe movement of the pedestrians should be ensured and proper Traffic Management Plan should be devised.
3.	Iqra University & Govt. Degree College	• Maximum construction work should be done after closing the educational institutions during the late-night hours. • Awareness among the students should be created about the projects. Traffic should be managed properly during the civil work construction.
4.	Health Department	• Awareness among the population about the risks associated the Project activities and mitigation measures should be created.

		• The environment of the most part of Project Area is friendly, but due to construction activities dust & air pollution may lead to respiratory diseases. Medical camp should be established in the area during the period of construction.
5.	Local Government Department	• The official briefed about advantages of the proposed Project as its implementation will benefit all the neighborhood along the route; • Traffic congestions in the Project Area will be reduced.
6.	Works & Services Department, GoS	• After the Project brief, the official was satisfied with the Project benefits and considered it as a good step for the development of the Project Area.
7.	Irrigation Department, GoS	• The official suggested regarding design that it should be such that it creates less hindrance in water way of the Malir River.; • Reimbursement must be done adequately
8.	Culture & Antiquity Department, GoS	• The official was satisfied with the Project benefits and considered it as a good step for the development of the proposed Project Area; • Prior approval from the department must be taken in case a heritage site comes in the ROW of the Project route.
9.	National Transmission & Dispatch Company (NTDC)	• The proposed Project is beneficial for the development of Project area; • Concerned department must be taken onboard before commencement of work
10.	Sui Southern Gas Company (SSGC)	• The proposed Project is beneficial for the development of Project area; • Concerned department must be taken onboard before commencement of work
11.	Sindh EPA	• It should be assured in design that all Sindh EPA guidelines are being followed; • Environmental Monitoring at all environmental sensitive areas along the route should be considered;
12.	Malir Bund Division	• The official informed that there is a lot of encroachment inside Malir bund; • Due to embankment of proposed road, catchment area of Malir River will be reduced so Impact on left bank should also be considered; • Encroachment inside left bank of Malir bund should be cleared
13.	Office of Director Marine Fisheries, Fisheries Department, Govt. of Sindh	• The department has no apprehension regarding impact on fish and fisheries by the construction of proposed Malir Expressway on the right bank of Malir River; • Presently, there is no fish in this area due to high level of pollution/organic load. The sewage water of different settlements and industrial effluents from Korangi Industrial area; • The aquatic life/fauna is restricted up to the mangrove area/estuary of the Malir River; • Industries may be forced to release their effluents after proper treatment to avoid the contamination of toxic materials and heavy metals in the estuary; • Construction contractors may be directed to avoid release of oil & other toxic waste of machinery & equipment into the river; • There should be no hurdle in the river bed so that organic load may flush to the estuary to fertilize the mangrove area.
14.	Office of Faisal Air Base, Pakistan Air Force, Karachi	• PAF officials further recommended to consider an interchange connectivity to the MEX from the air base specifically for the facilitation of air base.
15.	Office of Naval Provost Marshal,	• The route alignment has been shared with lieutenant Umar (office of NPM, PNS Nigran). The official suggested to take security clearance prior to starting work around the Mehran Air Base.

	PNS Mehran, Karachi	• The land from RD 3+500 to 5+800 is the property of Pak Army. Therefore, they should be taken onboard on this Project.
16.	Agriculture Department	• The official also recommended that minimum damages to agriculture crops especially to orchards should be inflicted during road construction. • The official showed his concerns that the proposed route is disturbing the agricultural land and fruit orchards permanently. He recommended that compensation should be paid to the affected at current market rates. • He also guided about the average yield of major crops and fruit products however suggested to consult the department related to compensation of the losses after finalization of assessment.
17.	Forest Department	• DFO informed that there is no reserved and protected forest in the vicinity of proposed Project. • He recommended that the compensation for the loss of trees should be carried out as per the Ten Billion Tree Tsunami Afforestation standards. • He further added to plant the native species along the road (on both side) as per the TBTTAP standards in consultation with officials of Forest Department.
18.	Wildlife Department	• The official informed that there is no protected area in the vicinity of proposed Project. • He also recommended the utmost care should be taken to protect the wildlife and other associated ecological resources for the sustainability of the ecological environment. • No faunal and floral species should be disturbed or damaged during all activities of the Project, and adequate mitigation measures should be adopted to mitigate the risks • He suggested to consider the passages for the movement of wildlife and livestock across the road. • The IBAT results were discussed among the experts of wildlife department and EIA team. The department official did not agree on the outcomes of the IBAT and they provided the relevant information of the project area and surrounding.
19.	Provincial Disaster Management Authority, GoS.	• The official agreed that Environmental study should be done on start of every Project so that all possible impact can be identified and concerned authorities can play their role more effectively.
20.	Karachi Water & Sewerage Board (KW&SB)	• Instead of relocation of structures, coming in ROW of Project alignment (like well), Protection works for such structures should be proposed.

6.4.2 Community Consultation and Participation Process

407. For ascertaining the perceptions of different stakeholders about the Project (during/ after construction) meetings were held within the Project area of influence. These meetings were held in an open atmosphere, in which participants expressed their views freely. Informal group discussions were also held as an additional tool for the assessment of the perceptions of the stakeholders about the Project and potential impacts both positive and adverse likely to occur due to its implementation.

a) Methods of Public Consultation

408. The following methods were used for public consultation with Project stakeholders to ascertain their stakes regarding Project implementation. The views of the beneficiaries were formally recorded. The locations selected randomly situated near the proposed route of the road.
    - Formal Group Meetings
    - Informal Group Meetings
    - Individual meetings
    - Focused Group Discussions (FGDs)
    - Gender Consultations

b) Locations of the Public Consultations

409. The detail of the locations with number of participation is provided in the **Table 6.5.**

Table 6.5: Stakeholders Contacted in the Villages/Town

Sr. No.	Village/ Town	Participants
1	Shah Faisal Colony	28
2	Magsi Goth	18
3	Sommo Goth	30
4	Along the Alignment	17

c) Categories of Stakeholders Contacted

410. Different categories of stakeholders contacted, during consultation is shown in the **Table 6.6**.

Table 6.6: Stakeholders Contacted in the Project Area

Sr. No.	Stakeholder Category
1	Residents
1	Farmers
2	Business/ shop owners
3	Government and private Servants
4	Drivers
5	Laborers

6.4.3 Consultations with Local Communities and Project affected Persons

411. Extensive consultations have been conducted with the local communities and Affected People in the Project Area to take their views and incorporating in the Project planning. Four consultative meetings were held with more than 93 participants in the Study Area. The major categories that participated in these meetings were local population, community groups, landowners, and Project Affected Persons (PAPs). The details of the participants with villages are given in **Table 6.7** below:

Table 6.7: Consultation Meetings and Participants

Sr. No.	Date	Venue	No. of Participants	Details of Consultation Meetings
1	14-11-2020	Shah Faisal Colony	22	Refer **Annex-XI**
2	15-11-2020	Magsi Goth	18	
3	15-11-2020	Sammo Goth	15	
4	14-11-2020	RD-13+000	03	
5	14-11-2020	RD-16+000	03	
6	14-11-2020	RD-18+000	04	
7	14-11-2020	RD-23+000	04	
8	14-11-2020	RD-35+000	03	

Sr. No.	Date	Venue	Occupation	Name
1	14-11-2020	Shah Faisal Colony	Driver	Muhammad Riaz
			Retired Govt. Servant	Jaffar Shah
			Mechanic	Javed Ali
			Driver	Nazakat Ali
			Mechanic	Muhammad Bilal
			Driver	Muhammad Riaz
			Retired Govt. Servant	Jaffar Shah
			Mechanic	Javed Ali
			Driver	Nazakat Ali
			Mechanic	Muhammad Bilal
			Retired Govt. Servant	Subhan Khan
			Business Operator	Naseeb Ullah
			Driver	M. Zheer Ullah
			Driver	Muhammad Saleem
			Driver	Arshad Ali
			Shopkeeper	Iqbal Ahmed
			Shopkeeper	Muhammad Aman
			Mechanic	Muhammad Salman
			Labour	Muhammad Ahsan
			Driver	Muhammad Nadeem
			In charge Cricket Ground	Muhammad Raza
			Driver	Muhammad Nadeem
Question Raised by the Participants				**Response of the Consultant**
• How much is the length of the proposed road and from where is passing? From where the road is starting and ending?				• The participants were briefed about the routes and lengths of the proposed road and its width with the help of design map.

Sr. No.	Date	Venue	Occupation	Name
• The road is crossing cricket ground which will damage the ground condition and the structures of the cricket ground. Proposed alignment of the road will affect the sports activities in the ground.				• The affected ground area will be shifted and paly ground will be restored as per condition before starting construction activities of the road. Proper compensation will be provided against the damage of structures for the reconstruction of all demolished structures
• Other social facilities (drinking water supply) have been proposed in the Project budget?				• At this stage only Malir Expressway has been proposed.
Case No.	**Date**	**Venue**	**Occupation**	**Name**
2	15-11-2020	Magsi Goth	Labour	Jan Muhammad
			Labour	Abdul Wahid
			Labour	Sikandar
			Labour	Muhammad Murad
			Driver	Muhammad Saleem
			Driver	Sardar Ali
			Driver	Saimdas
			Shopkeeper	Abdul Majid
			Shopkeeper	Wali Muhammad
			Labour	Ali Baig
			Labour	Muhammad Mushtaq
			Labour	Riaz Ahmed
			Labour	Jamal Khan
			Govt. Servant	Jamal Khan
			Labour	Abdul Razaq
			Labour	Zulfiqar Ali
			Labour	Muhammad Ayub
			Private Service	Amir Ali
Question Raised the Participants				**Response of the Consultant**
• Residential area falls in the ROW of the proposed road and residents of the Magsi Goth will be displaced. Will all DPs will be resettled. • Is it possible to change the alignment to avoid the adverse impacts on residential area? • What is the purpose of the public consultations and social survey?				• The compensation of all affected structures will be provided with all allowances and shifting allowances as per resettlement policies. • Impacts will be discussed with the design team to minimize the impacts on residential area and to avoid human disturbance. • The concerns of the local people will be addressed and design of the road will be improved with valuable suggestions.
Sr. No.	**Date**	**Venue**	**Occupation**	**Name**
3	15-11-2020	Sammo Goth	Labour	Muhammad Yaseen
			Labour	Muhammad Ameen

Sr. No.	Date	Venue	Occupation	Name
			Labour	Mushtaq Ahmed
			Labour	Muhammad Afzal
			Labour	Muhamad Akhtar
			Labour	Muhammd Sqlain
			Labour	Muhammad Saqlain
			Labour	Muhammad Imran
			Labour	Muhammad Imran
			Labour	Muhammad Sadam
			Driver	Muhammad Aslam
			Private Service	Shahzaib
			Labour	Abdul Rauf
			Labour	Muhammad Ibrahim
			Labour	Rajab Ali

Question Raised by the Participants	Response of the Consultant
• From where the route of the road has been proposed and from where of the area it is passing? • Residential area of the Sammo Goth is under impact and housing and religious structures will be affected will Displaced persons will be resettled? • Is there possibility to change the alignment to minimize the adverse impacts on the residential areas. • When will construction of the road start? • Private land will be under the impact and owners will be compensated?	• The route of the proposed road was briefed with the help of design map and showing GPS location in detail. • The compensation of all affected structures will be provided with all allowances and shifting allowances as per resettlement policies. • Alignment of the proposed route has been designed to minimizing the human disturbance. • After completion of all studies and final approval the construction of the road will start. • All affected persons of the land will be compensated against loss of their assets and land.

Sr. No.	Date	Venue	Occupation	Name
4	14-11-2020	RD-13+000	Farmer	Muhammad Sharif
			Farmer	Saleh Muhammad
			Farmer	Muhammad Imran
		RD-16+000	Private Service	Shakeel Ahmed
			Labour	Mirza Usman Ali
			Labour	Abdul Ghafar
		RD-18+000	Private Service	Abdul Sattar
			Imam Mosque	Abdul Razaq
			Labour	Khan Muhammad
			Labour	Wali Muhammadd
		RD-23+000	Labour	Hussain Balhsh
			Farmer	Bachal

Sr. No.	Date	Venue	Occupation	Name
			Famer	Ali Akbar
			Farmer	Irfan Ahmed
		RD-35+000	Business	Ali Badr ul Din
			Shopkeeper	Muhammad Ramzan
			Business	Haji Mashooq Ali Magsi
Question Raised by the Participants				**Response of the Consultant**
• What about the compensation of residential structures who have built at the government land? • How compensation for the land to be acquired will be paid and who will pay compensation?				• Compensation will be given to all DPs including the encroachers against their loss of structures and assets. • Land evaluation will be completed by Revenue Department after the demarcation of RoW of the proposed road and compensation package will be prepared for all land affected persons in the document of LARP as per National & Provincial Laws. For land compensation land amount will be transferred to Revenue Departments of districts.
• From where the labour force will be hired during the construction period. • Are there other civic facilities with the Project? Water filtration plant should be provided. • Local people will face difficulties to move other area due to construction of road.				• The contractor will be bound through agreement to hire maximum unskilled labour from the local area to benefit the local communities. • Suggestions for the provision of water filtration plant for locals and improvement of civic facilities in Project Area have been recorded. • Crossing will be provided at different locations and only main roads will be connected with the Malir Expressway

6.5 STAKEHOLDERS CONCERNS/FEEDBACK

412. Feedback received during public consultation includes both Project related concerns and other/general concerns. Project related concerns and suggestions are related to the willingness of people to accept Project loss of land, issues related to livelihood and compensation/relocation/resettlement. Other than these issues, drinking water, improper sewerage system, shortage of health facilities, poor road infrastructures, low education facilities, women related issues, agriculture and security were the other issues which were discussed and highlighted by the consulted community members. Brief Introduction about the proposed Project, its various components, positive and negative impacts, and other technical details related to environment, social and economic considerations were provided to the stakeholders.

413. During consultations concerns noticed are listed as under:

- Residential structures will be affected;

- Human displacement will occur at the large scale;
- Religious Structures (Mosques, Madrassas and Graveyards) will be affected
- Shrines at different locations fall in the proposed RoW will be affected;
- Cattle structures will be affected;
- Irrigation structures and fixtures will be affected;
- Adverse impact on the agricultural land and orchards;
- Disturbance for the local inhabitants and commercial activities in the area;
- Disturbance of livelihoods;
- Fronts of the houses will be blocked due to construction of the road in front of the houses;
- Different types of utilities will be affected during the implementation of the Project and local residents will face interruption of these facilities;
- Privacy of women will be disturbed due to outside labor force during construction work; and
- Dust & noise, disruption to Local inhabitants. Increase of traffic pressure on the local roads in the area due to construction activities.

6.6 SUGGESTION OF THE CONSULTED COMMUNITIES

414. Keeping in view the possible negative impacts of the current alignment of the proposed Project, the participants of the consultation meetings presented the following suggestions to minimize the adverse social Impacts of the proposed Project;

6.6.1 Suggestions of the Participants

- Impact on housing and commercial structures should be minimized, and if not avoidable, proper, and market-based resettlement compensation should be given.
- Civic facilities should be restored during the construction period of the road and after completion of the civil work;
- Civil work should be completed in the shortest possible time to avoid the adverse impacts on the daily activities and health of the people;
- Private land should be acquired at market price;
- Water storage tanks and other structures constructed by the Sindh water board fall in ROW and where these structures are under impact, the alignment should be changed and realigned;
- Crossing to water channels and irrigation structures should be provided to continue the supply of water to agriculture;
- Sign boards should be provided along the construction site;
- Proper arrangements should be done to avoid construction hazards;
- The local communities during the stakeholder consultations have shown great desire to be included in the Project's workforce.

415. In general, the consulted communities consider the Project beneficial for the area. Due to construction of road the allied sectors will be benefitted. Indirect benefits include employment opportunities for the locals and industry will also increase in Project Area, resulting in the increase of income and reduction in poverty.

6.7 GENDER CONSULTATIONS

416. Keeping in view the important role of the female in the household as well as in the society, gender consultations were also conducted in two (02) settlements to record views of the females and issues related to the Project implementation (list of participants is provided in **Table 6.8.**

Table 6.8: Consultation Meetings and Participants

Sr. No.	Date	Venue	No. of Participants	Details of Consultation Meetings
1	18-11-2020	Shah Faisal Colony	11	Refer **Annex-XI**
3	18-11-2020	Sammo Goth	15	

SHAH FAISAL COLONY					
Sr. No.	**Date**	**Name**	**Age**	**Education**	**Occupation**
1.	18-11-2020	Ms. Nasmeen Zafar	35	Graduate	Housewife
2.		Ms. Fazilat Jahan	55	Matric	Housewife
3.		Ms. Sabeen Zehra	36	Intermediate	Housewife
4.		Ms. Rizwana Qasim	58	Graduate	Housewife
5.		Ms. Anila Mahrukh	40	Middle	Housewife
6.		Ms. Najma Begum	40	Illiterate	Housewife
7.		Ms. Shabeena	35	Middle	Housewife
8.		Ms. Razi Quasar	27	Illiterate	Housewife
9.		Ms. Nasreen	40	Illiterate	Housewife
10.		Ms. Sarwat	35	Matric	Health Worker
11.		Ms. Nazish	19	Graduate	Student
SAMMO GOTH					
Sr. No.	**Date**	**Name**	**Age**	**Education**	**Occupation**
1.	18-11-2020	Ms. Asiay Khamiso	50	Illiterate	Housewife
2.		Ms. Shadia Zakar	30	Illiterate	Housewife
3.		Ms.Zahida G Mustafa	20	Illiterate	Housewife
4.		Ms. Najma Murtaza	25	Illiterate	Housewife
5.		Ms. Khalida Abdullah	25	Illiterate	Housewife
6.		Ms. Hamada Ali	22	Illiterate	Housewife
7.		Ms. Noor Jhan	19	Illiterate	Housewife
8.		Ms. Huma Rajab	28	Illiterate	Housewife
9.		Ms. Ramzan M Ali	24	Illiterate	Housewife
10.		Ms. Aysha Wali Moh	70	Illiterate	Housewife
11.		Ms. Hayaat Khatoon	35	Illiterate	Housewife
12.		Ms. Robina Latif	25	Illiterate	Housewife
13.		Ms. Najma Faisl	23	Illiterate	Housewife
14.		Ms. Jamila Khan Mohd	28	Illiterate	Housewife
15.		Ms. Yasmeen Taj Mohd	30	Illiterate	Housewife

6.7.1 Awareness, Concerns about the Project, and Response to their Queries

417. Women actively participated in the meetings and showed their support for the Project. Most of the women were un-aware about the Project. They considered the Project valuable to the local community and highlighted severe issues related to women due to Project execution. Their concerns were of major related to residential disturbance and mobility of women in the area.

418. Participants were briefed that adverse impacts have been minimized during designing the route of the road and residential settlements and affected families will be compensated properly before the Project implementation.

6.7.2 Problems Faced and Pressing Needs of the Women

419. The Project Area falls in both urban and rural areas, where needs and problems of women are different in nature related to the urban and semi urban areas. Female participants highlighted various issues faced in the area which are:

- Lack of facilities of safe drinking water;
- Insufficient health facilities;
- Insufficient educational facilities,
- Lack of Transport facilities; and
- Insufficient of training facilities in the semi urban areas.

420. Being residents of a rural area, the preferred needs of residents are clean drinking water, improved health facilities, better public transport, and employment opportunities.




Figure 6.1: Village Level Gender Consultation/Meetings

6.8 FOCUS GROUP DISCUSSIONS (FGDS)

421. Focus Group Discussions (FGDs) were conducted at Jumma Goth and Magsi Goth with the PAPs including landowners, small business operators and residential DPs. During

the FGDs, people were informed about the Project objectives and extensive question and answer sessions were conducted to clarify the Project related works and activities and resolve the resettlement issues. Participants were asked about the anticipated social issues which may raise in future due to construction of the proposed road as well as the possible solutions.

422. Participants of the discussions raised their concerns regarding resettlement issues and disturbance of their businesses due to construction work. In the same way, residents were also of the view that they will face hurdles in access to their houses due to road blockage and traffic hustles. They were briefed that the purpose of the consultations and discussions is to find out the possible solutions of these type of issues. Concerns have been recorded and all possible protective measure will be taken by the client and contractor to facilitate all possible affected persons including residents as well business operators. Importance of the proposed Project was highlighted during the discussions; participants were of the view that they have no doubt about the need for and importance of the Project. They were of the view, that after completion of the Project they will have an easy access to other parts of the city. These concerns will be addressed before and during construction. Participants of the discussion were satisfied with the consultations and showed their full cooperation for the smooth implementation of the Project.

6.8.1 Summary Concerns of the Participants of Focus Group Discussions (FGDs)

- Residential, commercial, and agricultural land will be under impact due to proposed Project.
- Access to social amenities will be disrupted.
- The community is doubtful for provision of proper compensation from Government side for affected structures. Particularly in case of squatters that they will not get any compensation for their residential and commercial structures.
- Due to construction activities, mobility of heavy vehicles will increase in the area which may increase road accidents.
- Dust and noise pollution will increase to a great extent during construction.

6.8.2 Summary of Measures Proposed by the Participants of FGDs

- Alignment of the proposed road should be finalized in such a way that minimum residential and commercial structures come under impact.
- Religious structures like shrines, graves and mosques should be avoided from demolishing as well as shifting by making proper changes in alignments.
- Market based compensation should be given for the land and other assets (residential and commercial).
- During construction phase, alternate route should be given to facilitate the local communities.
- Public utilities and social amenities should be restored at the earliest to facilitate the local communities.
- Mobility of heavy vehicles should be managed in night to avoid traffic blockage and reduce road accidents.

- Construction activities should continue in night to complete the proposed road at earliest.
- Dust and noise pollution should be managed by adopting proper mitigation measures.

6.8.3 Proposed Mechanism for Redressal of Grievances by the Participants of FGDs

- Grievance Redressal Committee (GRC) should be formed at local level to resolve the issues of local people. In this way, the grieved persons will easily approach the GRC for Redressal of his/her grievances.
- To reduce the number of complaints, actual market-based rates should be taken after market survey and applied for affected land and structures.
- Quick response should be given to complaints of the DPs for their facilitation.
- Effective working of GRC at local level will be beneficial for smooth implementation of the Project and grieved DPs will avoid going in court of law.

6.8.4 Anticipated Positive Impacts of the Project Highlighted by the Participants of FGDs

- Price of land and adjacent assets will increase.
- Business and commercial activities will increase to great extent.
- Good public transport will be available for movement.
- Access to other part of cities will become easier and more comfortable.
- During construction phase, local people may get job opportunities.
- Poor road infrastructure will turn into good roads.
- Due to construction of road, new industry may flourish in the area.
- Due to construction of road, this side of Malir Bund will become safer in context to floods in “Malir River”.

6.9 PROPOSED CONSULTATIONS PROGRAM AND STAKEHOLDER WORKSHOP

423. The stakeholder consultation and engagement process is an ongoing process and will continue throughout the Project’s construction as well as operation and maintenance phases. The ongoing consultation process will be made part of the environmental and social management plan which involves periodical consultations with project affected persons throughout the project life cycle.

424. The overarching goal of consultations and community engagement is to support and facilitate the Project’s design and implementation, to reduce conflicts and Project opposition, and to increase Project’s acceptability.

425. The community members will be compensated by the GoS and they will be encouraged to participate in Project activities during construction and operation phases.

426. Consultations will be carried out during the construction and operation phases of Project. Consultations will be undertaken in all the communities at least twice in a year,

depending on the number of concerns raised under each consultation. Ongoing stakeholders' engagement activities include:

- Ongoing reporting on progress on the implementation of environmental and social management measures identified during the EIA process and recording of comments on the effectiveness of these measures;
- Updating communities and other stakeholders about Project developments and recording comments on these; and,
- Ongoing action of the grievance mechanism.

427. Efforts will be made to maximize the consultations during Project implementation period. The consultations will be carried out with the objectives to develop and maintain communication linkages between the Project promoters and stakeholders, provide key Project information to the stakeholders, and to solicit their views on the Project and its potential or perceived impacts, and ensure that views and concerns of the stakeholders are incorporated during the implementation phase with the objectives of reducing or offsetting negative impacts and enhancing benefits of the proposed Project. The framework for the future consultations is elaborated in **Table 6.9,** but not limited to the following:

Table 6.9: Proposed Consultations Framework

Sr. No.	Stakeholders	Project Phase	Frequency of Consultation
1	Institutions/Departments	• Pre-Implementation • During the Project Implementation • At Closure period	• One round of consultation before start of implementation of Project. • Bi-annually during operation phase • Once before the closure of the Project.
2	Local Communities/ Key Persons	• Pre-Implementation • During the Project Implementation • At Closure period	• Consultation at different stages, before implementation, periodic meetings during construction phase and at the time of Project completion.
5	NGOs/CBOs	• Pre-Implementation • During Project Implementation • At Closure period	• Periodic meetings will be conducted as per requirement of the Project.

428. During the operational phase of the Project, consultation of stakeholder is important to assess the benefits of the Project and impacts on the local communities. A comprehensive stakeholder consultation plan as a part of the grievance redressal mechanism should be prepared by the contractor(s) to get feedback from the stakeholders and to resolve the issues during the construction phase of the Project.

7 ANTICIPATED PROJECT IMPACTS AND MITIGATION MEASURES

7.1 GENERAL

429. This chapter identifies the beneficial as well as the potentially significant adverse environmental and social impacts during the design/pre-construction, construction, and operation phases of the proposed Project on the physical, ecological, and socio-economic domains of the environment. The appropriate mitigation and remedial measures to offset the detrimental nature of these impacts are proposed in this chapter. A Project impact evaluation matrix has been developed to evaluate the potential impacts of the proposed Project. A brief qualitative description of each aspect and the affected environment in both RoW and the Project's corridor of impact is presented below.

7.2 SCOPING OF IMPACTS

430. Apart from positive impacts, there are some potential significant adverse environmental and social impacts on the local environment. The proposed Project is divided into three (03) stages i.e., Pre-construction / Planning and Design Stage, Construction Stage, and Operation and Maintenance (O&M) Stage.

431. Based on the reconnaissance survey, stakeholder consultations and consultant's experience, the potentially significant constraints or issues associated with the proposed Project have been identified, classified (high, medium, low). **Table 7.1** presents the identified potential impacts of the proposed Project intervention for design/preconstruction, construction, and O&M phases:

Table 7.1: Identification and Scoping of Potential Impacts

Sr. No.	Aspect / Activity	Potential Impact	Impact Significance	Duration
		Pre-Construction Phase		
1.	Permanent Land Acquisition	A little over 120 Acres of land will be acquired for the proposed Project and remaining is under the possession of GoS. Actual figures will be finalized in the Land Acquisition and Resettlement Plan.	High	Permanent
2.	Renting/Leasing Land	The Contractors will require renting/leasing land for the development of Contractor camps and facilities i.e. storage, workshops, equipment parking and washing areas.	Medium	Temporary
3.	Route Alignment	The route alignment has been finalized where the nexus of cost, engineering design, and overall impact meet. The alignment was chosen so as to displace the least number of persons possible.	Medium	Permanent
4.	Change in Hydrologic Regime	The proposed road will cross numbers of drainage structures and sewerage lines, however, where possible bridges have been incorporated to not disturb natural drainage. Furthermore, numerous pipe culverts and box culverts have been incorporated in the design of the Expressway to keep drainage patterns similar to as they are currently.	Low to Medium	Permanent
5.	Seismicity	The proposed Project is located, falls in Seismic Zone 2B region which may cause disruption of Project site and economic as well as public loss.	Medium	Permanent
6.	Public Utilities	Public utilities will be affected and will create disruption of public services and inconvenience to the residents due to proposed project construction activities, however, this will also inadvertently lead to the public utilities being upgraded.	Medium	Temporary
7.	Flora	Tree cutting during land clearing activities and establishment of construction site facilities such as camps, workshop, etc.	High	Permanent
8.	Socio-economic Environment	Locals may be temporarily disturbed due to the field investigations and drilling activities.	Low	Temporary

Sr. No.	Aspect / Activity	Potential Impact	Impact Significance	Duration
9.	Religious, Cultural, Historical Sites and Sensitive Receptor Religious, Cultural, Historical Sites and Sensitive Receptor	Several non-notified religious and cultural sites like shrines and graveyards exist near/in the RoW of the proposed road. These sites will be affected by proposed Project activities. No notified religious, cultural and historical sites exist in the RoW of the proposed road and near to the road. However, few non-notified sensitive receptors are located near to the proposed Project which may affect indirectly during construction stage. There are also some sites in the RoW which do not fall in the width of the road, hence, these may be salvaged.	Medium to High	Permanent
Construction Phase				
1.	Temporary Access Roads	There is no major accessibility issue related to the proposed Project site. However, at few locations contractor must develop a few new tracks which may cause soil erosion, soil contamination, air and noise problems.	Low	Temporary
2.	Land use	The land use of the Project Area is negatively disturbed during the construction stage activities.	Medium	Temporary
3.	Traffic Management	Due to the proposed construction activities and movement of heavy Project vehicles for construction material supply; traffic problems may arise for the commuters and transporters travelling to the proposed areas. The problems will include traffic jams and inconvenience to the public passing through the Project Area.	Medium	Temporary
4.	Community Health and Safety	The construction activities and vehicular movement at construction sites may result in roadside accidents, deterioration of quality of groundwater and surface water resources and spread of different transmittable diseases (HIV, COVID-19, etc.) due to outside labour.	Medium	Temporary
5.	Occupational Health and Safety	Occurrence of accidents / incidents during the construction stage is a common phenomenon and workers as well as locals will be more prone to serious accidents.	High	Temporary

Sr. No.	Aspect / Activity	Potential Impact	Impact Significance	Duration
6.	Soil Erosion	Construction activities such as clearing of earth, levelling, compaction, carpeting, pavement finishing will affect the existing soil condition in the CoI.	Medium	Temporary
7.	Soil Contamination	Land may be contaminated due to the spillage of chemicals, fuels, solvents, oils, paints, concrete, solid waste generated at campsites etc.	Medium	Temporary
8.	Wastewater Generation at Construction Camps	Wastewater will be generated at the construction camps and from construction activities. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources.	Medium	Temporary
9.	Solid Waste Generation at Construction Camps	Considering the labourers residing in the construction camp and the locally available labour, a considerable amount of solid waste apart from the construction and demolition waste will be generated. The improper disposal of waste will cause detrimental impacts to local inhabitants and workers at site.	Medium	Temporary
10.	Construction and Demolition Waste Generation at Construction Site	The construction and demolition waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials etc.). The handling and storage of oil and other hazardous waste will be a source of environmental pollution.	Medium	Temporary
11.	Borrow Pits	Borrow/ open pits and its excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments and may also become potential sources of mosquito breeding proving hazardous to human beings and livestock.	Medium	Temporary
12.	Public Utilities	Various utilities such as electrical poles of 11kV transmission lines, telephone lines and tube-wells /wells are situated within the RoW or crossing the proposed road.	Medium	Temporary

Sr. No.	Aspect / Activity	Potential Impact	Impact Significance	Duration
13.	Ambient Air Quality	Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles.	Medium	Temporary
14.	Noise and Vibrations	Noise and vibration will be produced due to the operation of construction machinery and equipment such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers, asphalt plants and other equipment's. The cumulative effects from several machines can be significant and may cause significant nuisances.	Medium	Temporary
15.	Greenhouse Gases (GHGs) Emissions	The main sources of greenhouse gases during the construction activities of the proposed Project will include both mobile and stationary equipment, machinery, and vehicle sources. Emission of greenhouse gases causes global warming and other climatic changes on regional and global scale.	Medium	Temporary
16.	Flora	The proposed Project will involve destruction of vegetation cover (agriculture land and trees/shrubs) in Project Area particularly along the temporary access roads/camp sites.	Medium	Temporary
17.	Mangroves	No impact	--	--
18.	Fauna	During construction phase the existing population of mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving clearance of RoW, excavation, movement of machinery and vehicular traffic, movement of labor, camping, etc.	Low to Medium	Temporary
19.	Social Impacts	The social disturbance, social conflicts due to influx of external Workforce, occupational Health and Safety (OHS) issues, spread of communicable and epidemic diseases may be issues that arise during the project.	Medium	Temporary
20.	Gender Issues	As the Project route is passing near settlements, it may cause gender issues to the local inhabitant women especially working in the field.	Medium	Temporary

Sr. No.	Aspect / Activity	Potential Impact	Impact Significance	Duration
21.	Livelihood Loss	During construction activities, people will suffer loss in their annual income due to the loss of crops, trees, and other income sources.	High	Permanent
Operational and Maintenance Phase				
1.	Landscape	During the operation stage, new saplings of different indigenous plants and trees will be planted to enhance the aesthetics and compensate the loss of affected trees.	Low	Permanent
2.	Air Quality	Improvement in road conditions in the city will help reduce traffic related emissions by allowing a smoother traffic flow.	Low	Permanent
3.	Road Safety	Enhanced vehicular movement and speed in the long run may result in road safety issues like traffic accidents.	Medium	Temporary
4.	Drainage	A proper drainage system for the expressway drainage has been planned which must be maintained adequately to ensure that water does not accumulate on the expressway and damage the infrastructure.	Low to Medium	Temporary
5.	Safety and Security	Safety and security of the local communities and road travelers.	Low	Temporary

7.3 METHODOLOGY FOR IMPACT EVALUATION

432. The methodology adopted for the evaluation of the impacts included the following assessment tools, (i) Project impact evaluation matrix and (ii) overlays. These tools were used to identify the significance and magnitude of the impact as well as the nature, reversibility, extent etc.

a) Project Impact Evaluation Matrix

433. The Impact Evaluation Matrix was developed by placing Project activities along one axis (i.e., Y-axis), and on the other axis (i.e., X-axis) the different environmental parameters likely to be affected by the proposed Project actions grouped into categories i.e., physical, ecological, and socio-economic environment. For the impact assessment, Project impact evaluation matrix was used by dividing the Project action into different phases (design/pre-construction, construction, and operational phases). A Project Impact Evaluation Matrix is given as **Table 7.2 (a, b, c)**.

b) Overlays

434. To identify spatial based impacts, overlays were used. An overlay is based on a set of transparent maps, each of which represents the spatial distribution of an environmental characteristic (for example, land acquisition, accessibility, etc.). Information for an array of variables such as land use, infrastructure, vegetation etc. was collected for the standard geographical units within the Project's CoI, recorded on a series of maps, typically one for each variable. These maps were overlaid to produce a composite map. The resulting composite maps characterize the Project area's land use, physical, social, ecological, and other relevant parameters related to proposed intervention. The overlays maps used in this EIA study for the quantification of the land use categories referred in Chapter 5.

7.4 NOTION OF SIGNIFICANCE FOR IMPACT EVALUATION MATRIX

435. The term ***"Environmental Impact"*** or simply *"**Impact**"* covers the negative, adverse, or harmful as well as positive, desirable, or beneficial impacts of the Project on environmental settings. Prediction of impacts of the proposed activity is based on factual data; however, the significance of these impacts involves a value judgment technique. The nature of the impacts may be categorised in terms of:

Direction	-	Positive or Negative
Duration	-	Long or Short Term
Effect	-	Direct or Indirect
Extent	-	Wide or Local

436. Impact significance depends on both the nature of the impact and on the sensitivity of the receptor. The more sensitive the receptor the greater will be the significance of impact from that proposed activity. For this EIA, activities and nature of impact are combined with the sensitivity of the receptor to evaluate the significance of the impact.

The significance of impact is characterized as very low, low, moderate, high, and very high. Environmental issues having “moderate”, “high” and “very high” significance are provided with mitigation measures.

437. Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the impact significance criteria matrix as shown below. Most of the potential impacts can be mitigated by implementation of various types of mitigation measures; however, some residual environmental impacts may remain after mitigation.

Magnitude of Impact	Sensitivity of Receptors			
	High (4)	**Medium (3)**	**Low (2)**	**Negligible (1)**
Major (4)	16	12	8	4
Moderate (3)	12	9	6	3
Minor (2)	8	6	4	2
Negligible (1)	4	3	2	1

Score	Impact Significance
1	Negligible
2 – 4	Low
5 – 8	Medium
9 – 12	High
> 12	Very High

438. Based on this notion of significance, a Project Impact Evaluation Matrix has been established which is given in **Table 7.2 (a, b, c)**.

Environmental Component / Project Component	Physical Environment					Ecological Environment							Socio Economic Environment																	
	Soil (Erosion/Stability/ Contamination)	Air Quality	Noise Level	Surface & Ground Water Quality	Solid Waste Generation	Aquatic Ecosystem	Terrestrial Ecosystem	Endangered Species	Migratory birds	Beneficial Plants	Loss of trees	Loss of Crops/Orchards	Conflict over Resources	Mobility of Locals	Public Infrastructure	Accessibility	Housing Infrastructure	Cultural Properties (Mosque, Shrine, Graveyard	Community Stability	Tourism And Recreation	Grazing Area	Gender Issues	Cultural & Social Issues	Health& Safety	Aesthetic	Security Situation	Living Standards	Employment Opportunities	Restoration of Livelihood	Economic Uplift
A. Planning & Design Phase	1	2	3	4	5	8	8	9	10	11	12	13	14	15	16	17	18	18	20	21	22	23	24	25	26	27	28	29	30	31
Topographic Survey	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Geotechnical Investigation	0	0	2	3	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0
Temporary Acquisition of Land	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0
Parmanent Acquisition of Land	0	0	0	0	0	0	0	0	0	4	9	9	6	0	6	0	9	6	9	0	0	0	9	0	0	6	6	0	0	0

Positive Impact Score	Impact Significance	Adverse Impact Score
0	Negligible	0
2 to 4	Low	2 to 4
5 to 8	Medium	5 to 8
9 to 12	High	9 to 12
>12	Very High	>12

Table 7.2 (a): Project Impact Evaluation Matrix (Pre-Construction Phase)

Environmental Component → / Project Component ↓	Physical Environment					Ecological Environment							Socio Economic Environment																	
	Soil (Erosion/Stability/ Contamination)	Air Quality	Noise Level	Surface & Ground Water Quality	Solid Waste Generation	Aquatic Ecosystem	Terrestrial Ecosystem	Endangered Species	Migratory birds	Beneficial Plants	Loss of trees	Loss of Crops/Orchards	Conflict over Resources	Mobility of Locals	Public Infrastructure	Accessibility	Housing Infrastructure	Cultural Properties (Mosque, Shrine, Graveyard	Community Stability	Tourism And Recreation	Grazing Area	Gender Issues	Cultural & Social Issues	Health& Safety	Aesthetic	Security Situation	Living Standards	Employment Opportunities	Restoration of Livelihood	Economic Uplift
B. Construction Phase																														
RoW / Site Clearance	9	9	9	8	8	4	6	o	o	4	9	9	o	6	4	3	6	6	o	o	6	o	8	9	4	4	o	6	o	4
Earthwork in Filling and Excavation	9	9	9	8	8	4	4	o	o	o	o	o	o	6	2	3	o	o	2	o	o	o	6	9	4	4	o	6	o	4
Establishment of Construction Camps & Workshop	2	2	4	o	o	o	4	o	o	o	o	4	8	o	o	o	o	4	4	o	o	4	4	8	4	o	o	6	6	6
Transportation & Storage of Construction Materials	4	6	6	2	4	o	2	o	o	o	o	4	o	4	o	o	o	o	4	o	o	o	4	6	4	o	o	4	o	o
Use of Construction Material and Heavy Machinery	3	8	9	o	4	2	4	o	o	o	o	o	o	2	2	2	o	o	o	o	o	o	2	8	o	4	o	4	o	o
Installation and operation of Batching and Asphalt Plants	4	8	8	2	4	2	2	o	o	o	o	o	2	o	o	o	o	2	o	o	o	o	o	6	4	o	4	4	o	o
Spoil Disposal	3	3	o	6	6	4	6	o	o	o	4	6	o	o	o	o	o	o	2	o	o	o	4	4	6	o	o	o	o	o
Structural & Civil Work	8	8	8	7	7	4	6	o	o	o	o	o	2	o	2	o	o	o	2	o	o	4	6	9	4	4	o	8	o	8
Drainage Work	6	6	6	7	6	6	6	o	o	o	o	o	2	o	2	o	o	o	2	o	o	4	4	9	4	4	o	8	o	8
Miscellaneous Work (Road Ancillaries, Traffic Signs and Signals etc.)	o	4	6	4	4	2	2	o	o	o	o	o	o	o	2	o	o	o	o	o	o	o	o	6	o	o	o	6	o	6
Pavement Work	2	4	6	2	4	2	2	o	o	o	o	o	o	o	o	o	o	o	o	o	o	2	2	8	o	o	o	6	o	6
Finishing and Comissioning	o	2	4	o	4	o	2	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	4	o	o	o	4	o	4

Positive Impact Score
0
2 to 4
5 to 8
9 to 12
>12

Impact Significance
Negligible
Low
Medium
High
Very High

Adverse Impact Score
0
2 to 4
5 to 8
9 to 12
>12

Table 7.2 (b): Project Impact Evaluation Matrix (Construction Phase)

Environmental Component / Project Component	Physical Environment					Ecological Environment							Socio Economic Environment																
	Soil (Erosion/Stability/ Contamination)	Air Quality	Noise Level	Surface & Ground Water Quality	Solid Waste Generation	Aquatic Ecosystem	Terrestrial Ecosystem	Endangered Species	Migratory birds	Beneficial Plants	Loss of trees	Loss of Crops/Orchards	Conflict over Resources	Mobility of Locals	Public Infrastructure	Accessibility	Housing Infrastructure	Cultural Properties (Mosque, Shrine, Graveyard	Community Stability	Tourism And Recreation	Grazing Area	Gender Issues	Cultural & Social Issues	Health& Safety	Aesthetic	Security Situation	Living Standards	Employment Opportunities	Restoration of Livelihood	Economic Uplift
C. Operational Phase																													
Operation of Road	0	2	2	0	0	0	4	0	0	0	6	0	0	6	4	8	0	0	6	4	0	0	8	6	8	4	8	6	6	6
Inspection & Monitoring	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	2	4	0	4	0	4	0	0
Road Maintenance	0	4	4	2	0	0	2	0	0	0	0	4	0	4	4	4	0	0	0	0	0	0	0	6	2	0	0	4	0	0
Maintenance of Miscellaneous Work	0	0	2	0		0	0	0	0	0	0	0	0	2	2	2	0	0	0	0	0	0	0	4	0	0	0	4	0	4

Positive Impact Score
0
2 to 4
5 to 8
9 to 12
>12

Impact Significance
Negligible
Low
Medium
High
Very High

Adverse Impact Score
0
2 to 4
5 to 8
9 to 12
>12

Table 7.2 (c): Project Impact Evaluation Matrix (Operation and Maintenance Phase)

7.5 POTENTIAL ADVERSE IMPACTS

439. Apart from positive impacts, there are some potentially significant adverse environmental and social impacts on the local environment. The proposed Project is divided into three (03) stages i.e., Pre-construction / Planning and Design Stage, Construction Stage and Operation and Maintenance (O&M) Stage. The Pre-Construction Stage includes all stages before the construction Stage (i.e., site investigation works i.e., topographical, geotechnical, seismic studies etc.); Construction Stage includes all stages from mobilization of Contractor to the completion of Project; and Operation Stage starts after the Construction Stage which includes the inspection and repair works.

440. Adverse impacts envisaged at these three (03) stages of the proposed Project along with their proposed remedial or mitigation measures are detailed below.

7.5.1 Adverse Impacts during Planning and Design Phase

441. Potential adverse impacts during the planning and design stage of the Project are given below:

7.5.1.1 Land Acquisition and Resettlement

Potential Impacts

442. For the construction of proposed road, Interchanges, and its fencing, approximately 1000 acres of land will be acquired, out of which most is government land and over 100-150 acres of land is private land. The ownership record of affected land will be prepared by the Revenue Department according to separate categories of the land.

Impact on Residential Structures

443. In the RoW housing structures of different categories will be affected fully due to Project intervention. In addition to these structures, hand pumps, boundary walls and other related structures are also under the impact. The summary of residential structure is provided in **Table 7.4**.

444. The inventory of land, the detailed measurement of structures and the number of households to be affected by the acquisition of land will be completed during the phase of detailed planning with the help of the revenue and other departments in preparing the separate LARP.

Impact on Commercial Structures

445. Different types of commercial structures will be impacted due to clearance of RoW for the Project activities. These households will have a temporary impact on sources of

livelihood until the re-establishment of their business in a new location. The summary of commercial structure is provided in **Table 7.4.**

446. The inventory of land, the detailed measurement of structures and the number of households to be affected by the acquisition of land will be completed during the phase of detailed planning with the help of the revenue and other departments in preparing the separate Land Acquisition and Resettlement Plan.

Impact on Community and Religious Structures

447. Some Mosques fall in the RoW of the proposed Project. The summary of these structures is provided in **Table 7.4.**

448. The inventory of land, the detailed measurement of structures and the number of households to be affected by the acquisition of land will be completed during the phase of detailed planning with the help of the revenue and other departments in preparing the separate LARP.

449. Categories of structures and with location have been given in the **Table 7.4** below. Index map of affected structures is provided in **Figure 7.1** whereas the detailed maps are provided in **Annex-VII.**

Table 7.3: Indicative Summary of The Affected Structures*

Sr. No.	Category of Structures	Detail of Structures	Approximate Number Structures
1	Residential	Pacca-Semi Pacca Katcha and Hut	345
		Front of the house in the RoW	21
		Total	366
2	Commercial	Shops and service station etc.	31
3	Religious and Community Structure	Mosques	10
		Madrassa	03
		Shrine	01
4	Cattle Structures	Sheds	03
5	Irrigation Structures	Tube wells	04
6	Government	Cricket ground	01
		KMC Sewerage Structures (Compound)	01
		Structures of Sindh Water Board	02
		Utilities	
		Electric Pols	
7	Other	Structures and fixtures	10

*Based on initial survey of ROW and measurement of structures, will be further finalized by the Revenue department after finalization of Section IV

Mitigation Measures

450. The Land Acquisition Act (LAA) of 1894 is the main law regulating land acquisition for public purposes. This impact can be mitigated by ensuring compliance of the Land Acquisition Act, 1894, and addressing community grievances on a priority basis and through timely compensation to affected.

451. The process of land acquisition and compensation should be followed in a transparent manner to minimize detrimental impacts and to provide judicious compensation to the displaced by providing sufficient budget in the Project cost. According to the Land Acquisition Act 1894, the following points are to be considered while determining compensation for the Project affected**:**

- Land that will be coming under ROW should be acquired according to Land Acquisition Act (LAA), 1894 for which a Land Acquisition and Resettlement Plan (LARP) for the proposed Project should be prepared:
- Compensation should be evaluated and provided as per market rates.
- The market value of land and 15% compulsory land acquisition surcharge, compensation all orchards, crops and trees;
- Affected Persons should be compensated on full replacement cost of each category to construct a new structure of the same type; and
- Proper consultations and coordination's with DPs during resettlement process.

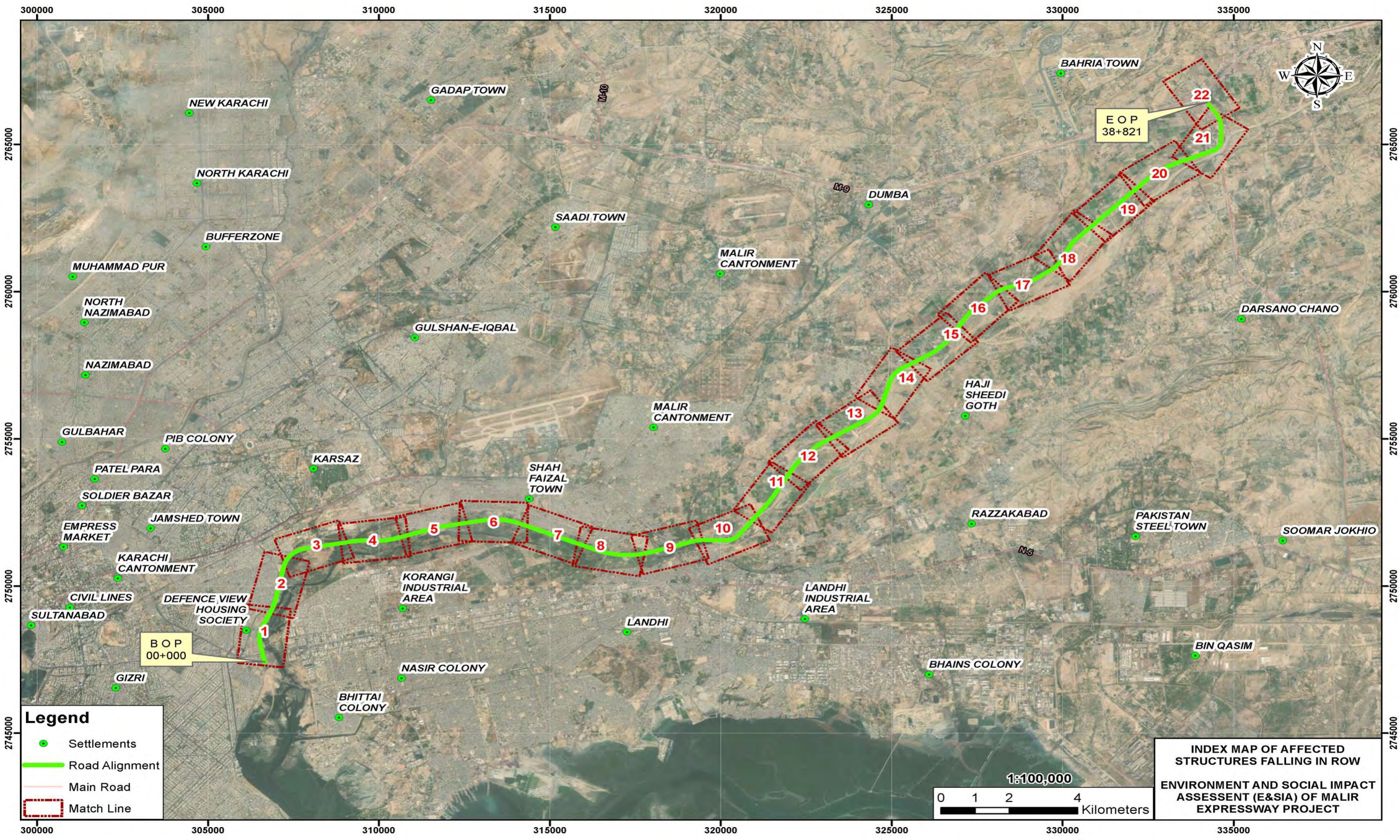

Figure 7.1: Index Map of Affected Structures

7.5.1.2 Renting/Leasing Land

Potential Impacts

452. The Contractors will require renting/leasing land for:

- The development of Contractor camps and facilities i.e., storage, workshops, equipment parking and washing areas;
- Aggregate quarries; and
- Access roads/tracks for haulage, transportation etc.

453. Land utilization for Project activities and subsequent operation of Project may induce temporary changes in the existing land use pattern. This impact can be categorized as direct, low, site-specific, short term, temporary, medium probability and reversible.

Mitigation Measures

454. It is the foremost option to establish the Contractor camps at the acquired land to eliminate the issues of leasing land etc. However, if this option is not feasible than the land for above mentioned facilities should be selected and leased prior to the start of construction phase.

455. Land for above mentioned facilities will be directly rented from the private landowners by the Contractors. The provisions of the Land Acquisition Act (LAA), 1894 will not be involved as the acquisition of the land will be temporary and will be covered by short-term lease agreements between the landowners and Contractor. Rental terms should be negotiated to the satisfaction of the concerned landowners and the agreement should be in local language to make the process clear.

456. As far as possible, waste/barren land i.e. areas not under agricultural or residential use and natural areas located at high elevation should be used for setting up the contractor camps.

7.5.1.3 Route (Alignment) Optimization

Potential Impacts

457. The proposed MEX follows existing alignment along the right bank of the Malir river. Improper route selection of proposed MEX may lead to disturbance to settlements (Sommo Goth, Shafee Goth, Magsi Goth, Bachal Goth, Memon Goth, Dumlottee, etc.) which will generate social issues. This impact would be of moderate significance.

Mitigation Measures

458. The proposed Project is carefully aligned to avoid social issues up to maximum extent possible including resettlement, damage to infrastructure, etc. The finalized alignment should strictly be followed to avoid social disturbances.

7.5.1.4 Loss of Agriculture Land

Potential Impacts

459. Due to the proposed Project, over 225 acres of agricultural land (refer **Table 5.12**), where Lucerne, vegetables and fodders are cultivated, will be affected and crop yield will be disturbed. But in the long run, due to the construction of the proposed Project, better transport facilities and opportunities will be available to the farmers to enhance the crop yield and supply to different parts of the city and the country.

Mitigation Measures

- Agricultural Land coming under RoW should be acquired as per market rates defined in LARP of the proposed Project that will be developed.

7.5.1.5 Flora

Potential Impacts

460. During the pre-construction phase, activities such as installation of construction camps, construction of temporary roads & mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed, which require significant space, available vegetation is expected to be removed.

461. The trees and shrubs, coming within the RoW of the road shall be removed. The fruit orchards/fruit trees and non-fruit or forest tress will be affected. The number of possibly impacted tress is provided by GIS and tree identification is carried out in field. The detail assessment was carried out by the joint visits of the consultant team, concerned agriculture and Forest departments.

462. Trees act as a binding force as their roots are spread in the soil, which helps to keep the soil intact. With the removal of trees, this binding force will be reduced, and the soil will be liable to increased erosion. This impact is however constrained to the construction phase when there will be no structure present.

Mitigation Measures

- The camps, mobility of machinery, and construction of temporary roads shall be properly planned and well designed to avoid any loss to local green cover.
- It is recommended to establish construction camps where minimum to no vegetation exists.
- Similarly, the alternate routes for roads and points for camps are recommended where no loss of vegetation is expected.
- The location of construction camp will be selected so, as to have limited environmental effect during construction phase and to reduce the cost and land requirement.
- Cutting of trees and disturbance of orchards shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species is minimized.
- Utmost effort shall be made to save as many trees as possible and minimize the loss of vegetation.
- As a principle, ten trees shall be planted in place of one tree cut down to compensate for the trees removed.
- The client shall implement the program with the help of Forest Department and with the consultation of concerned consultant ecologist.
- The Forest Department and agriculture department shall involve local communities for carrying out plantation.
- The indigenous trees most suited to the tract should be re-planted.

7.5.1.6 Change in Hydrologic Regime

Potential Impacts

463. Although proposed Project alignment passes along the Malir River which is a non-perennial stream, however, no change in hydrological regime is anticipated due to this Project. Four (04) numbers of nullahs (including one main tributary of Malir River near RD 34+200), numbers of sewerage and storm water drainage outlets/network are being crossed by the proposed Project at different locations. The RD wise location of these nullahs is mentioned in **Table 7.5** and are presented in map **Figure 5.6**. There might be change in water flow pattern to these structures and disturbance during the construction of proposed Project, however, to mitigate this as much as possible, the expressway will be adopting bridge structures along these stretches to ensure that the functioning of these nullahs is not disturbed. Furthermore, the expressway has incorporated numerous pipe and box culverts along the route to ensure that the hydrology of the area remains as unchanged as possible. This impact is low in nature.

Table 7.4: RD Wise Nullah Crossing MEX

Sr. No.	RD	Nullah Description	Length of Bridge (m)
1	4+823	Nullah Behind PAF Museum	80
2	5+773	Chakora Nullah	200
3	15+973	Thaddo Nullah	150
4	34+200	Malir River Tributray (Koncar Nadi)	150

Mitigation Measures

464. Bridges are proposed at the crossings of these nullahs. While box and pipe culverts are being proposed along with specific design arrangements for the crossing of the sewerage and storm water drainage outlets. The direct CoI of the surface water bodies will be confined by the RoW of the Project, and it will be minor and temporary in nature.

7.5.1.7 Public Utilities

Potential Impacts

465. Due to the proposed Project, public utilities will be affected creating disruption of public services and inconvenience to the residents. Various utilities such as electrical poles of 11kV transmission lines, telephone lines and tube-wells /wells are situated within the CoI of the proposed Project. The proposed road will cross High Voltage transmission lines (220 kV and 500 kV) at RD 00+250, 00+625 12+400, and 25+750 locations. Huge government structures such as sewerage tanks of KMS, water storage tanks of SWB and other important structures fall in the RoW of the proposed Project. These utilities will be relocated before the start of construction activities. These utilities if not handled properly will cause difficulties to the peoples of Project Area. This impact can be categorized as direct, low, site-specific, short term, temporary, low to medium probability and reversible.

Mitigation Measures

466. Mitigation measures will include:

- Proper compensation and restoration mechanism of public utilities will be considered during LARP study;
- The provision in the design and budget for the relocation of the existing utility infrastructures wherever required shall be finalized in consultation with the concerned departments;
- All public utilities (e.g. water pipes, power/ telephone lines, sewerage of KMC water storage structures of KWSB etc.) likely to be affected by the proposed Project will be relocated well ahead of time before the actual commencement of the construction work.
- Strengthening of utilities, wherever required;
- Close coordination with the concerned departments to curtail inconvenience to the residents of the Project Area;
- Timely public notification of unexpected disruption of services; and
- The Contractor shall in no instance excavate around or over live buried electrical cable or pressurized gas lines during the construction or allow such to be suspended across open excavations in a manner that, in the opinion of the Resident Engineer, threatens public or worker safety. Neither shall water lines be left suspended and unsupported across open excavations.

7.5.1.8 Physical, Religious and Cultural Resources

Potential Impacts

467. According to the field survey, some mosques and Dargan Mai Niani are falling in the Right of Way of the structure. All these structures fall in RoW may be directly affected and demolishing of these structures may cause social issues. Some of these structures can be avoided however, as while they fall in the RoW of the project, they do not fall in the alignment of the road.

Mitigation Measures

468. Due consideration shall be given to minimize the adverse impacts on the religious and community structures and places. Where the structures fall in the RoW, the residents of the area along with the team preparing the Land Acquisition and Resettlement Plan will work on an amicable solution.

7.5.1.9 Resource Conservation

Potential Impact

469. Resources involved in the construction of proposed Project would include water, fuel, and construction materials.

470. Excessive water consumption by the construction staff may stress water resources in the Project Area and in certain cases may disturb the existing water supplies in the Project Area. Construction material to be used for construction includes coarse aggregates, fine aggregates, asphalt, cement, lining material, earthworks, reinforced and structural steel etc. Almost all the materials to be used in the construction of proposed Project are non-renewable and therefore their efficient use is necessary for impact minimization.

471. Fuel will be used to operate construction machinery. Efficient use of energy resources is important to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is important. The impact is minor negative.

Mitigation Measures

472. Following practices shall be adopted to conserve these natural resources:

- Use water bowsers for construction works and mineral water bottles/ ground water for drinking purpose;
- Plan for the provision/purchase of adequate insulation to reduce heat loss through batching plants;
- Reduction of wastage of water through training of workers involved in water use;

- Reuse of construction waste materials to be adopted wherever possible;
- Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment;
- Equipment and machinery should be well maintained;
- The equipment and machinery should be turned off when not in use;
- Regularly monitor CO and CO_2 content of the flue gases to verify that combustion systems are using practical excess air volumes; and
- A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater, and solid waste volumes to the lowest levels.

7.5.1.10 Seismicity

Potential Impact

473. The Project Area is in Seismic Zone 2B, where 2B (upper limit of moderate damage) represents peak horizontal ground acceleration from 0.16 to 0.24 g. In this Zone, designing of various types of structures should be done based on Peak Ground Acceleration (PGA). A low to moderate intensity earthquake impacting the Project site can adversely impact the development if adequate measures are not incorporated in design. This impact can be categorized as direct, medium, site-specific, short term, temporary, medium probability and reversible.

Mitigation Measures

474. The proposed road and the associated structures should be designed and constructed as per Seismic Building Code of Pakistan 2007 (SBC-07) to comply with minimum requirements for seismic safety of structures.

7.5.1.11 Fauna

Potential Impacts

475. No threatened faunal species were recorded in the study area (COI of proposed MEX Alignment) during the field survey. The habitat values for fauna in the study area are generally limited. The vegetation is mostly composed of young native landscape plantings and the ground layer is heavily grazed or mown. As such, the overall condition of fauna habitat is considered poor, where only species that can tolerate human disturbance or thrive on human presence survive.

476. However, as movement and installations of machinery and vehicles during the construction phase will take place so noise and habitat loss of domestic fauna (avi-fauna, reptiles, rodents, etc.) is expected. This impact is site-specific, temporary, irreversible, and low significant.

Mitigation Measures

- Appropriately designed and suitably located culverts of varying sizes, underpasses and fences will provide effective mitigation to overcome barrier effects of roads. Wildlife/ cattle crossings have been designed to offer two main benefits:
    - Connect habitats and wildlife populations; and
    - Ensure safety of travellers and reduce mortality of wildlife on roads.

- Safety measures during design phase should include the following aspects, as appropriate:
    - Safety fencing and signage should be designed at livestock influx areas and wildlife hotspots if any.
    - Safe speed limit will be strictly designed, to ensure fatal accidents involving wildlife or humans could be avoided.
    - Caution boards should be planned and erected then at crossing areas of wild animals. The exact location for boards would be determined through a survey of crossing animals.
    - Awareness material regarding wildlife will be developed and displayed prominently at the sites frequented visited by humans.

- Clearing of vegetation must be carefully planned and strictly monitored;
- The sites for the constructions camps should be carefully selected keeping in mind the available faunal habitats along the Project Area. Moreover, the layout of camps need to be designed while considering the faunal habitat of that area. Wildlife movements and routes must be considered in this regard;
- Prior to commencing any construction work, any works required outside the construction footprint verified should be referred to the Environment Manager of related authority (PMIU) for advice on further assessment and approval requirements so that damage to any available habitat over there could be avoided at maximum;
- Sindh Wildlife & Biodiversity Act 2020, WB OP 4.04 Natural Habitats must be followed for compliance;
- Moreover, proper planning should be done for food storage, as setting up of kitchens, production of sewage and waste water may result in multiplication of rodents like rats, mice and shrew etc. and vectors like mosquitoes, bugs and flies which will have a negative impact.

7.5.2 Adverse Impacts during Construction Stage

7.5.2.1 Temporary Access Roads

Potential Impact

477. The proposed Project can be approached through various major road and railway network from upcountry. The construction material, equipment and machinery will be arrived at proposed area and construction camps sites. From these camps, the material, equipment, and machinery will be transferred to work site.

478. **Existing Approach Roads:** The proposed MEX is approachable through major roads such as Motorway (M9) - National Highway (N5) Link Road, Dumlottee Road, Malir River Road, Malir Dam Road, Malir Cantt Road, National Highway-Super Highway Link Road, Malir – Shah Latif Town Road, Sommo Goth Road, Malir River Bridge Road, Korangi Link Road, Korangi - Shah Faisal Road, Malir Right Bank Road, EMB Causeway, Shaheed-e-Milat Expressway and Korangi Road near KPT Interchange. Detail of major road crossing are provided in the **Table 7.6** and index map of the same is shown in **Figure 7.2**.

Table 7.5: Major Road Crossings along the Route

Sr. No.	RD Stretch	District	Major Road Crossing Detail
1	0+250	Korangi	Jam Sadique Bridge – Main Korangi Road)
2	2+000 to 2+750	Korangi	Shaheed e Millat Road (along the MEX)
3	3+000	Korangi	EBM Causeway
4	9+200	Korangi	Shah Faisal Korangi Link Road
5	14+875	Korangi	Railway Line
6	15+250	Korangi	Shahra e Faisal (N5)
7	24+000	Malir	National Highway – Super Highway Link Road
8	25+500	Malir	Malir Dam Road
9	27+250 to 28+000 33+000 to 36+750	Malir	Dumlottee Road
10	37+000 to 38+250	Malir	Along M9-N5 Link Road

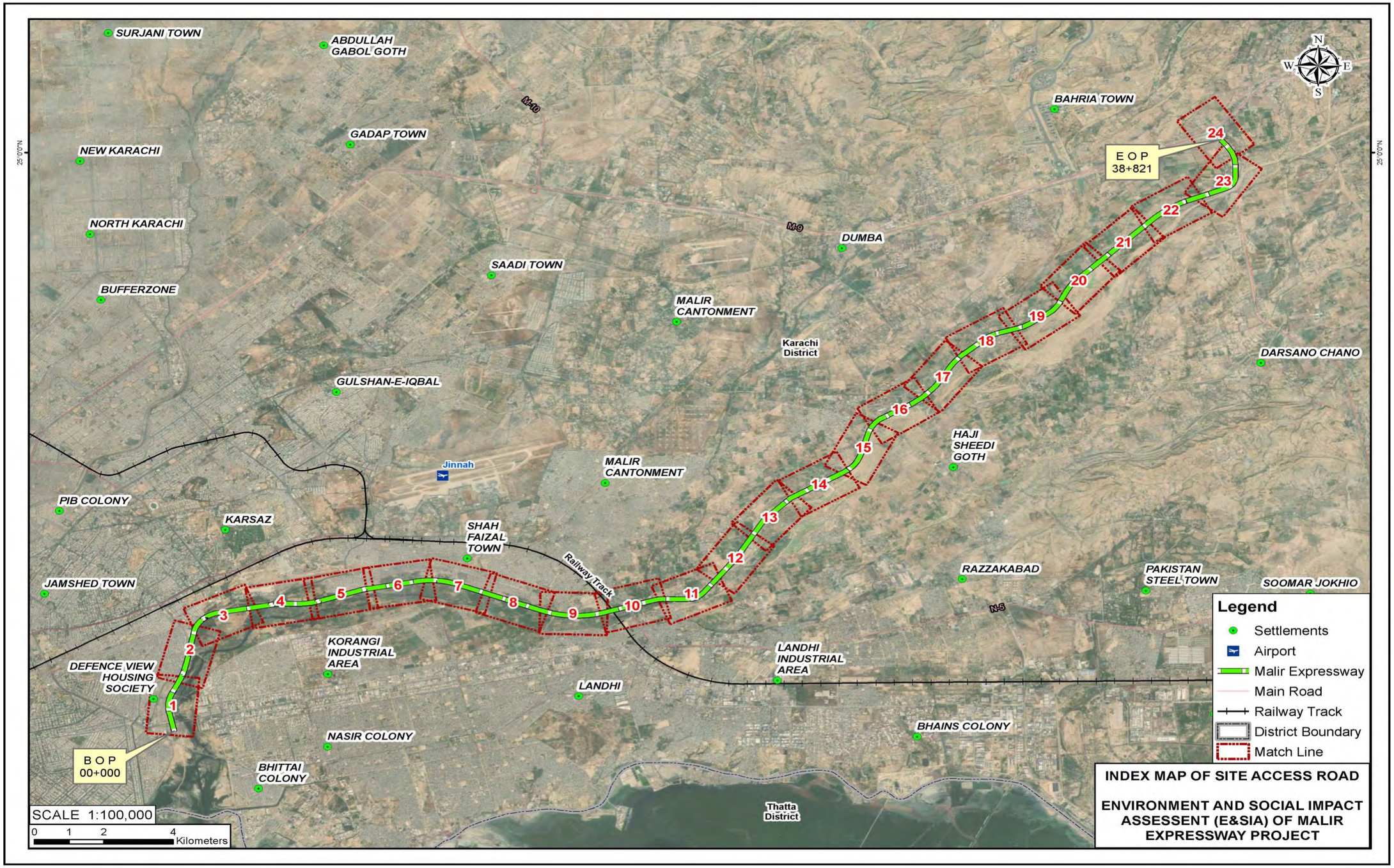

Figure 7.2: Site Access Road Index Map

479. Apart from above existing roads, few accessibility tracks may need to be developed which may cause damage to trees and crops, soil erosion, soil contamination, air and noise problems. This impact can be categorized as direct, low, site-specific, short term, temporary, medium probability and reversible.

Mitigation Measures

480. According to usual practices during the construction of roads, the access road will be developed within the RoW of the proposed project. This will limit and reduce the additional impact of the establishment of the access roads for the proposed Project. For the development of access roads/tracks, contractor will be bound to consider the following mitigations to further reduce the severity of this impact:

- Selection of access roads/tracks should be based upon certain criteria to ensure high stability, no or minimum tree cutting and crop damage, minimum disturbance to nearby settlements and other social amenities.
- The approach roads should be selected to avoid any soil degradation and erosion impacts.
- Special care should be taken for known sensitive areas to ensure that all interested parties are aware of the type and location of work being done. Measures should be taken where necessary to protect such areas physically.
- Mitigations for the loss of tress and crops, soil erosion, soil contamination, air and noise pollution, waste generation, and loss of agricultural land provided in below sections will be adopted.

7.5.2.2 Traffic Management

Potential Impact

481. The proposed road will be approached through various major roads as mentioned in sub-section 7.6.2.1. These roads serve as main approach roads to the proposed Project Area and due to the proposed construction activities and movement of heavy Project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling to the proposed areas. The problems may include traffic jams and inconvenience the public passing through the Project Area. It will also increase traffic load on the existing road network or access roads ultimately deteriorating the existing condition of the roads. The movement of vehicles along the haulage routes will cause soil erosion, debris flow, dust emissions, vibrational impacts, etc. Considering these consequences, this impact can be categorized as direct, moderate, site-specific, medium term, temporary, medium probability and irreversible.

Mitigation Measures

482. To minimize traffic problems in the proposed Project Area, following measures will be considered:

- Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the night-time to reduce traffic load and inconvenience to the local population;
- Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid un-necessary congestions along the major roads;
- Damages of roads due to construction vehicles will be instantly repaired and/or compensated after the completion of work; and
- Proper sign boards will be provided for smooth flow of traffic.
- Period of construction and area / location of construction site shall be informed to public in general and specifically to residents.
- Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays.

483. *Traffic Management Plan (TMP)* has been proposed (refer **Annex-XIII**). However, the contractor may take guidance from this TMP and prepare site specific TMP which will be implemented to avoid traffic accidents, jams/public inconvenience in the Project Area.

7.5.2.3 Community Health and Safety

Potential Impact

484. Community health and safety issues during the construction of proposed MEX may include dust, noise, and vibration from construction vehicle transit, and communicable disease associated with the influx of temporary construction labor. Significant community health and safety issues associated with road projects may also include:

- Pedestrian safety
- Traffic safety
- Emergency preparedness

485. The construction activities and vehicular movement at construction sites may result in roadside accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, roadside accidents, etc. The proposed Project will also have potential of air (dust pollution), noise and vibration impacts on nearby community (Shah Faisal Colony, Sommo Goth, Shafee Goth, Magsi Goth, Bachal Goth, Memon Goth, Dumlottee, etc.). Labor with different transmittable diseases (HIV/AIDS, COVID-19, etc.) may cause spread of those diseases in the residents of above-mentioned settlements along the MEX. The construction areas located near the residential/settlements may cause accident for the people moving near to these areas. Considering these consequences, this impact can be categorized as direct, moderate, site-specific, medium term, temporary, medium probability and irreversible.

Mitigation Measures

- Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, specifically those related to pedestrian facilities or bikeways;
- Setting of speed limits appropriate to the road and traffic conditions; and
- An emergency preparedness and response plan in coordination with the local emergency responders (e.g. Rescue 1299) to provide timely first aid response in the event of accidents and hazardous materials response in the event of spills.
- Instruct foremen to strictly enforce the keeping out of non-working persons, particularly children, off work sites;
- Timely public notification on planned construction works;
- Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links;
- Reducing the impacts of vector borne diseases on long-term health effect of workers should be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which include Prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat close to residential areas and by eliminating any unusable impounding of water;
- The communicable diseases of most concern during construction phase, such as HIV/AIDS, COVID-19 will be prevented by successful initiatives typically involving health awareness; education initiatives; training heath workers in disease treatment; immunization program and providing health services.

7.5.2.4 Occupational Health and Safety

Potential Impact

486. Occupational Health and Safety (OH&S) related impacts will arise during construction stage activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. In a nutshell, the occupational health and safety issues associated with the construction of proposed MEX will primarily include physical hazards; chemical hazards; and noise.

487. **Physical Hazards:** Road construction personnel can be exposed to a variety of physical hazards, principally from operating machinery and moving vehicles but also working at elevation on bridges and overpasses. Other physical hazards (e.g., exposure to weather elements, noise, work in confined spaces, trenching, contact with overhead power lines, falls from machinery or structures, and risk of falling objects).

488. Eye injury can be caused by stone or metal particles. Hazard of being hit by falling objects, major hand-arm and whole-body vibration hazards, skin, and respiratory tract irritation from exposure to cement dust, overexertion and awkward postures etc. will be another impact. Welding hazards include electric shock, fumes and gases, fire, and explosions, falls from height, eye, and head injuries etc.

489. Other impacts will be fall from height, contact with heavy electrical and mechanical equipment, equipment failure, uncontrolled movement, unguarded moving mechanical equipment parts, fatigue, unbalanced load, falling objects, hand injury, slip and trip

hazards, wind / storm activity, injury from releasing load too soon etc. Operating mechanical and electrical equipment will trigger the H&S issues e.g., struck by moving vehicles or other equipment, slips or trips, struck by flying objects, such as dirt or splashed fluids, caught in pinch points, shear points, crush points, falling from machine etc. The proposed Project Area is also sensitive from the law-and-order point of view and the security as well as the safety of the Contractor and Consultant staff will be a major issue.

490. ***Chemical Hazards*** in the proposed MEX construction may be principally associated with exposures to dust during construction and paving activities; exhaust emissions from heavy equipment and motor vehicles during all construction activities; diesel fuel used as a release and cleaning agent for paving equipment and in generators; and handling and storage of bitumen.

491. ***Noise:*** Construction and maintenance personnel may be potentially exposed to extremely high levels of noise from heavy equipment operation and from working in proximity to vehicular traffic. As most of these noise sources cannot be prevented, control measures should include the use of personal hearing protection by exposed personnel and implementation of work rotation programs to reduce cumulative exposure.

492. In addition, disasters such as earthquakes and fires may occur. Lack of Emergency Response Plan (ERP) or an inefficient response plan may lead to an accident or critical injury. Considering these consequences, this impact can be categorized as direct, moderate, site-specific, medium term, temporary, medium probability and irreversible.

Mitigation Measures

493. Mitigation Measures to prevent and control physical hazards include:

Moving Equipment and Traffic Safety:

- Establishment of work zones to separate workers on foot from traffic and equipment by:
- Routing of traffic to alternative roads when possible;
- Where worker exposure to traffic cannot be completely eliminated, use of protective barriers to shield workers from traffic vehicles, or installation of channelling devices (e.g. traffic cones and barrels) to delineate the work zone;
- Regulation of traffic flow by warning lights, avoiding the use of flaggers if possible;
- Reduction of maximum vehicle speeds in work zones; and
- Training of workers in safety issues related to their activities, such as the hazards of working on foot around equipment and vehicles; and safe practices for work at night and in other low-visibility conditions, including use of high-visibility safety apparel and proper illumination for the work space (while controlling glare so as not to blind workers and passing motorists).

Elevated and Overhead Work:

- The area around which elevated work is taking place should be barricaded to prevent unauthorized access. Working under personnel on elevated structures should be avoided;
- Hoisting and lifting equipment should be rated and properly maintained, and operators trained in their use. Elevating platforms should be maintained and operated according to established safety procedures including use of fall protection measures (e.g. railings); equipment movement protocols (e.g. movement only when the lift is in a retracted position); repair by qualified individuals; and installation of locks to avoid unauthorized use by untrained individuals;
- Ladders should be used according to pre-established safety procedures for proper placement, climbing, standing, as well as the use of extensions; and
- Provide appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE.

Fall Protection

- Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others;
- The fall protection system should be appropriate for the structure and necessary movements, including ascent, descent, and moving from point to point;
- Safety belts should be not less than 16 millimetres (mm) (5/8 inch) two-in-one nylon or material of equivalent strength. Rope safety belts should be replaced before signs of aging or fraying of fibres become evident; and
- When operating power tools at height, workers should use a second (backup) safety strap.

494. Mitigation Measures to prevent and control chemical hazards include:

- Use of millers and pavers with exhaust ventilation systems and proper maintenance of such systems to maintain worker exposure to crystalline silica (millers and grinders) and asphalt fumes (pavers) below applicable occupational exposure levels;
- Use of the correct asphalt product for each specific application, and ensuring application at the correct temperature to reduce the fuming of bitumen during normal handling;
- Maintenance of work vehicles and machinery to minimize air emissions;
- Reduction of engine idling time at active construction sites;
- Use of extenders or other means to direct diesel exhaust away from the operator;
- Use of protective clothing when working with cutbacks (a mixture of asphalt and solvents for the laying of pavement), diesel fuel, or other solvents; and
- Provide appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE.

495. Furthermore, the noise reduction options that should be considered which include:

- Selecting equipment with lower sound power levels;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing vibration isolation for mechanical equipment;
- Providing noise protection PPEs (ear plugs/ear muffs) to the construction workers;

- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding;
- Developing a mechanism to record and respond to complaints; and
- Regular monitoring of noise levels at active sites or near noise producing equipment/machinery and compare it to the available occupational noise standards.
- No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection.

Monitoring of OHS Activities:

496. During the construction phase of proposed MEX, occupational health and safety monitoring programs of the contractor (s) should verify the effectiveness of prevention and control strategies. The selected indicators should be representative of the most significant occupational, health, and safety hazards at the construction site and camps, and the implementation of prevention and control strategies. The occupational health and safety monitoring program should include:

- Regular inspection and testing of all safety features and hazard control measures focusing on engineering and personal protective features, work procedures, places of work, installations, equipment, and tools used;
- *Surveillance of the working environment:* The contractors should document compliance using an appropriate combination of portable and stationary sampling and monitoring instruments. Monitoring and analyses should be conducted according to internationally recognized methods and standards. Monitoring methodology, locations, frequencies, and parameters should be established individually for each Project following a review of the hazards;
- Continuous and efficient surveillance of worker's health during the entire construction phase by the nominated officials of contractors; and
- *Training:* Training activities for employees (construction contractor & supervision consultant staff) and visitors should be adequately monitored and documented (curriculum, duration, and participants). Emergency exercises, including fire drills, should be documented adequately. Service providers and contractors should be contractually required to submit to the employer/PMIU adequate training documentation before start of their assignment.

General Mitigation Measures for OHS of Workers and Community during Construction Phase:

- Complying with the safety precautions for the construction workers as per International Labour Organization (ILO) Convention No. 62, as far as applicable to the Project Contract;
- Formulation of layout plan for camp site, indicating safety measures taken by the contractor, e.g. firefighting equipment, safe storage of hazardous material, first aid, security, fencing, and contingency measures in case of accidents;
- Work safety measures and good workmanship practices are to be followed by the contractor to ensure no health risks for labourers;
- Provision of adequate sanitation, washing, cooking and dormitory facilities including light up to satisfaction;
- Proper maintenance of facilities for workers shall be monitored;
- Provision of protective clothing for labourers handling hazardous materials, e.g. helmet, adequate footwear for bituminous pavement works, protective goggles,

gloves, etc. Ensure strict use of wearing these protective clothing during work activities;
- Contractor will ensure the provision of medicines, first aid kits, ambulance etc. at the camp site;
- Provision of proper safety and diversion signage, particularly at sensitive/accident-prone spots; and
- Disasters such as earthquakes, flooding, due to heavy rain and other manmade disasters such as fires may occur, and that must be considered for minimizing their impacts. Therefore, an Emergency Response Plan for earthquakes and manmade disasters should be developed by the PMIU in consultation with the construction contractor and Rescue 1299 Services.
- Construction Camp Management Plan (CCMP) and effective implementation of GRM may reduce this impact.

Contractor(s) shall prepare a comprehensive OHS Plan including work method statements for all hot works to avoid incidents during construction stage. A guideline OHS Plan is provided in **Annex-XIV.**

7.5.2.5 Green House Gas (GHG) Abatement

Potential Impact

497. The main sources of greenhouse gases (CO_2, CH_4, NO_x etc.) during the construction activities of the proposed Project will include both mobile and stationary sources. The mobile source will be the construction and transportation vehicles while the stationary source will be the batching and asphalt plants. Emission of greenhouse gases cause global warming and other climatic changes on regional and global scale. Cutting of trees along the RoW will also reduce the carbon sequestering and overall increase the CO_2 content in atmosphere which is one of the major GHGs. Based on the current Project schedule and commencement strategy, the construction work will be completed in almost 30 months. Considering the gradual commencement of work in stretches and same trend for the tree removal/cutting within the Project corridor, the baseline trees will be reduced in same proportion as the cutting of trees increased with time. Apart from the cutting of trees, the emissions from fuel-based machinery/equipment and vehicles during construction stage will increase the magnitude of this impact.

498. Based on the magnitude and severity, the impact is categorized as medium to high level.

Mitigation Measures

499. Plantation development as per the tree plantation/reforestation plan is highly recommended for the sequestration of CO_2. As per reforestation plan, approximately 19,500 numbers of trees will be planted during the construction stage in parallel to the tree cutting rate and their maintenance up to 01 year. The estimation was carried out by considering the zero CO_2 sequestration rate of newly planted trees during their maintenance phase as very negligible CO_2 sequestration will take place.

500. Apart from the above, other minor level emissions of GHGs from material and vehicles during construction stage will be controlled through following mitigations:

- Implement vehicle exhaust emission controls including the following:
  - Regular maintenance of vehicles, plant, and machinery in accordance with manufacturer's specifications.
  - Monthly visual inspections on vehicle and plant exhausts to identify excessive emissions of smoke, and maintenance undertaken where required.
  - Approved pollution control devices to be fitted to equipment and machinery.
  - Transport vehicles shall not be overloaded.
  - Switch off / throttle down all site vehicles and machinery when not in use.
  - Avoid unnecessary idling of equipment.

7.5.2.6 Air Quality

Potential Impact

501. Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles. Emissions may be carried over longer distances depending upon the wind speed, direction, temperature of surrounding air and atmospheric stability.

502. Potential impacts on the air quality during the construction stage will be due to the fugitive dust emissions and the exhaust gases generated in and around the construction site. Dust is a major component of air pollution, generated mainly from the following construction activities:

- Site clearance and use of heavy vehicles and machinery/equipment etc. at construction site;
- Procurement and transport of construction materials such as sand, cement, etc. to the construction site;
- Other Gaseous emissions during construction result from operating of construction vehicles, plant, and equipment (asphalt and batching plants).
- Increase in air pollution levels without Project and with Project during construction period (for mobile & stationary sources) is predicted from construction machinery, equipment, which reveals that there shall not be significant contribution towards pollution due to the construction activity of the Project if mitigation plan will be implemented and monitored in proper sense.

503. The construction activities will also result in increased air pollution in the area. The overall impact on the quality of air during the construction phase will, however, be temporary and limited to the Project's implementation phase only. This impact can be categorized as direct, low, site-specific, short term, temporary, medium probability and reversible.

Mitigation Measures

504. The impacts construction phase of the proposed Project could be effectively mitigated by the implementation of simple procedures by the Contractor including but not limited to the following:

- All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions;
- Open burning of solid waste from the Contractor's camps and at construction site should be strictly banned;
- Preventive measures against dust should be adopted for on-site mixing and unloading operations.
- Construction materials (sand, gravel, and rocks) and spoil materials will be transported trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the SEQS (as amended) for carbon emissions and noise;
- Regular water sprinkling of the site should be carried out to suppress excessive dust emission(s);
- Emissions from power generators and construction machinery are important point sources at the construction sites. Proper maintenance and repair is needed to minimize the hazardous emissions; and
- Construction equipment is generally left idling while the operators are on break or waiting for the completion of another task. Emissions from idling equipment tend to be high. Existing idling control technologies, which automatically shut the engine off after a priest time can reduce emissions, without intervention of the operators.
- SEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works.
- Service roads (used for earthmoving equipment and general transport) should be regularly sprayed with water during dry weather;
- All excavation work should be sprinkled with water;
- Construction workers should be provided with masks for protection against the inhalation of dust;
- Vehicles used for construction should be tuned properly and regularly to control emission of exhaust gases.
- Ensure precautions to reduce the level of dust emissions from hot mix plants, crushers and batching plants should be taken up; e.g. providing them as applicable, with protection canvasses and dust extraction units. Mixing equipment should be well sealed and equipped as per existing standards; and
- Regular monitoring of air quality in accordance with SEQS.

7.5.2.7 Noise/Vibration

A. Noise:

Potential Impact

505. Noise will be produced due to the operation of construction machinery and equipment. Sources of noise during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers, asphalt

plants and other equipment's. Noise is perceived as one of the most undesirable consequences of construction activity. The above machinery is expected to generate noise levels that would be severe in the Project Area.

506. The cumulative effects from several machines can be significant and may cause significant nuisances. However, these increased noise levels will prevail only for a short duration during the preconstruction and construction stage. The noise produced by construction equipment is presented in **Table 7.7** below as reference.

Table 7.6: Noise Produced by Construction Equipment

Sr. No.	Equipment	Noise dB(A) at 15ft from Source
1	Wheeled loading	90
2	Grader	90
3	Vibration pavement roller	86
4	2-wheel vibration pavement roller	81
5	3-wheel pavement roller	81
6	Tire pavement roller	76
7	Bulldozer	86
8	Wheeled pneumatic dredger	84
9	Sprayer	87
10	Power generator	98
11	Impact drill	87
12	Impact pile driver	112
13	Truck	92
14	Concrete mixer	91
15	Concrete pump	85
16	Mobile lift	96
17	Pneumatic hammer and rock crusher	98
18	Breaker	84
19	Pneumatic spanner	95

Source: Quagliata, A., Ahearn, M., Boeker, E., Roof, C., Meister, L., & Singleton, H. (2018). Transit Noise and Vibration Impact Assessment Manual (No. FTA Report No. 0123).

507. The likely impacts due to noise are:

- Psychological effects of distraction of attention, irritation, and short temperedness in the exposed persons due to persistently higher noise levels; and
- Noisy settings and higher background levels can cause temporary threshold shift and the consequent habit of speaking loudly, which may cause damage to vocal cords in the persons exposed.

508. This impact can be categorized as direct, medium, site-specific, short term, temporary, medium to high probability and reversible.

Mitigation Measures

509. There are a variety of ways by which construction equipment and worksite noise can be controlled. The following is a list of ways to control noise level at the worksite of the proposed Project:

Quieter Equipment

510. A cost-effective way to reduce noise at a construction worksite is to buy quiet equipment. In addition, equipment in use should be the most suitable for the job. Avoid using equipment that is over-powered and, conversely, avoid using under powered equipment. Whenever possible the quietest equipment alternative should be used. In general, electronic powered equipment is quieter than diesel powered equipment and hydraulically powered equipment is quieter than pneumatic power.

Modifying Existing Old Equipment

511. The most common way to reduce the noise levels of common construction equipment is through worksite modifications. Some common worksite modifications consist of retro-fitting existing equipment with damping materials and mufflers.

Work Activity Scheduling

512. Work activity scheduling is an administrative means to control noise exposure. Planning how noise sources are sited and organized on a work site can reduce noise hazards. Jobs can be rotated so that exposure time is limited. Transferring workers from a high exposure task to a lower exposure task could make the employee's daily noise exposure acceptable. Administrative controls include activity planning, for example, scheduling pavement breaking operations to reduce the number of work site workers exposed. In addition, noisy equipment should not be run for periods longer than necessary and should be switched off when not in use.

Maintenance

513. Increased attention to maintenance of tools and equipment will reduce worksite noise levels. Maintaining plant and equipment in good order not only increases its life but makes it safer to use and quieter. Loose and worn parts should be fixed as soon as possible. Ideally, the worksite should have a system in place for checking and servicing the various machines and power tools.

B. Vibration:

Potential Impact

514. The duration and amplitude of vibration generated by construction equipment varies widely depending on the type of equipment and the purpose for which it is being used. In assessing vibration from construction equipment, it is useful to categorize the equipment by the nature of the vibration generated. Various equipment categories according to type of vibration and/or activities in each category are listed below:

515. Equipment or activities typical of continuous vibration include:

- Excavation equipment;
- Static compaction equipment;
- Tracked vehicles;
- Road traffic;
- Vibratory pile drivers;
- Pile-extraction equipment; and
- Vibratory compaction equipment.

516. Energy from construction equipment is transmitted into the ground and transformed into vibration, which weakens with distance. The magnitude and attenuation of ground vibration is dependent on the following:

- The efficiency of the energy transfers mechanism of the equipment (i.e. impulsive, reciprocating, rolling or rotating equipment);
- The frequency content;
- The impact medium stiffness;
- The type of wave (surface or body); and
- The ground type and topography.

517. Vibration generated by construction activity has the potential to damage structures. This damage could be structural damage, such as cracking of floor slabs, foundations, columns, beams, or wells, or cosmetic architectural damage, such as cracked plaster, stucco, or tile. The predicted ground vibrations at various distances are shown in **Table 7.8** for typical equipment that may be used during proposed road construction. The typical vibration from heavy trucks is generally low, and usually imperceptible in nearby buildings.

Table 7.7: Typical vibration levels at distances (Peak mm/s)

Plant Item	**Peak Vibration (mm/s), Distance from Source**			
	10m	***20m***	***50m***	***100m***
15t roller	7.0 to 8.0	3.8	1.5	0.8
7t compactor	5.0 to 7.0	3.0	1.2	0.6
Dozer	2.5 to 4.0	1.6	0.7	0.3
Backhoe	1.0	0.5	0.2	0.1

Source: Environmental Noise Management Manual-Roads & Traffic Authority, NSW, Australia, 2001

518. Based on the predicted peak vibration levels described in **Table 7.8**, it is expected that vibration would be barely perceptible at sensitive receiver locations within 50m for most construction activities involving rolling and compacting.

519. According to *British Standards of Noise and Vibration*, humans are particularly sensitive to vibration with the threshold of perception typically being in the range of 0.14 to 0.3

mm/sec[34] Peak Particle Velocity (PPV) and levels above this may cause annoyance. However, significantly higher levels than this can be tolerated for single short-term events and do not cause annoyance or disturbance to humans. The British Standard (BS 5228-2) provides guidance on vibration and its control and management on various site types. The standard also presents details on the human response to vibration and **Table 7.9** outlines these effects.

Table 7.8: Guidance on Effects of Vibration Levels

Vibration level	Effect
0.14 mm/sec	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/sec	Vibration might be just perceptible in residential environments.
1.0 mm/sec	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
10 mm/sec	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

Source: *British Standards Code of Practice for Noise and Vibration Control on Construction and Open Sites, 2014*

520. Similarly, British Standard (7385-2) *'Evaluation and Measurement for Vibration in Buildings, A Guide to Damage Levels Arising from Ground borne Vibration'* provides guidance on vibration measurement, data analysis and reporting as well as building classification and guide values for building damage. These Standard states that there should be no cosmetic damage to buildings if transient vibration levels do not exceed 15mm/sec in the low frequency range and this rises to 20mm/sec at frequencies of 15Hz and to 50mm/sec at 40Hz and above. These guidelines should be reduced by up to 50% for listed structures or similar. It is also noted that the probability of damage for transient vibrations tends towards zero at 12.5mm/sec at component PPV. For continuous vibrations, the threshold is considerably less at around half this value.

521. **Table 7.10** presents the vibration levels below which there is no risk of damage to buildings. These limits apply to vibration frequencies below 15Hz where the most conservative limits are required and are presented for both transient and continuous vibrations. For protected or potentially vulnerable buildings, the recommended construction vibration limit is reduced by half.

[34] *BS 5228-2: British Standards Code of Practice for Noise and Vibration Control on Construction and Open Sites, 2014*

Table 7.9: Maximum Permissible Construction Phase Vibration Levels

Building Type	Vibration Limit - PPV for Transient Vibrations for Frequencies <15Hz	Vibration Limit – PPV for Continuous Vibrations for Frequencies <15Hz
Structurally sound and not protected structures	12.5 mm/s	6.25 mm/s
Protected and/or vulnerable structures	6 mm/s	3 mm/s

Source: British Standard (7385-2) 'Evaluation and Measurement for Vibration in Buildings, A Guide to Damage Levels Arising from Groundborne Vibration', 1993

522. ***Existing Vibration Climate (Baseline Conditions):*** To give an indication of existing vibration levels that can be expected in the vicinity of the proposed Project site, baseline vibration monitoring was carried out at five monitoring locations (sensitive receptors, see **Figure 7.4**). Continuous vibration monitoring was conducted at each monitoring location. The average concentrations were found to be in the range of 0.23 to 0.34 mm/sec at the monitoring locations (refer **Table 7.11**). There are no significant sources of vibration in the vicinity of the proposed Project. The main vibrations experienced at the nearest sensitive receptor locations relate to the passing traffic along the surrounding road network.

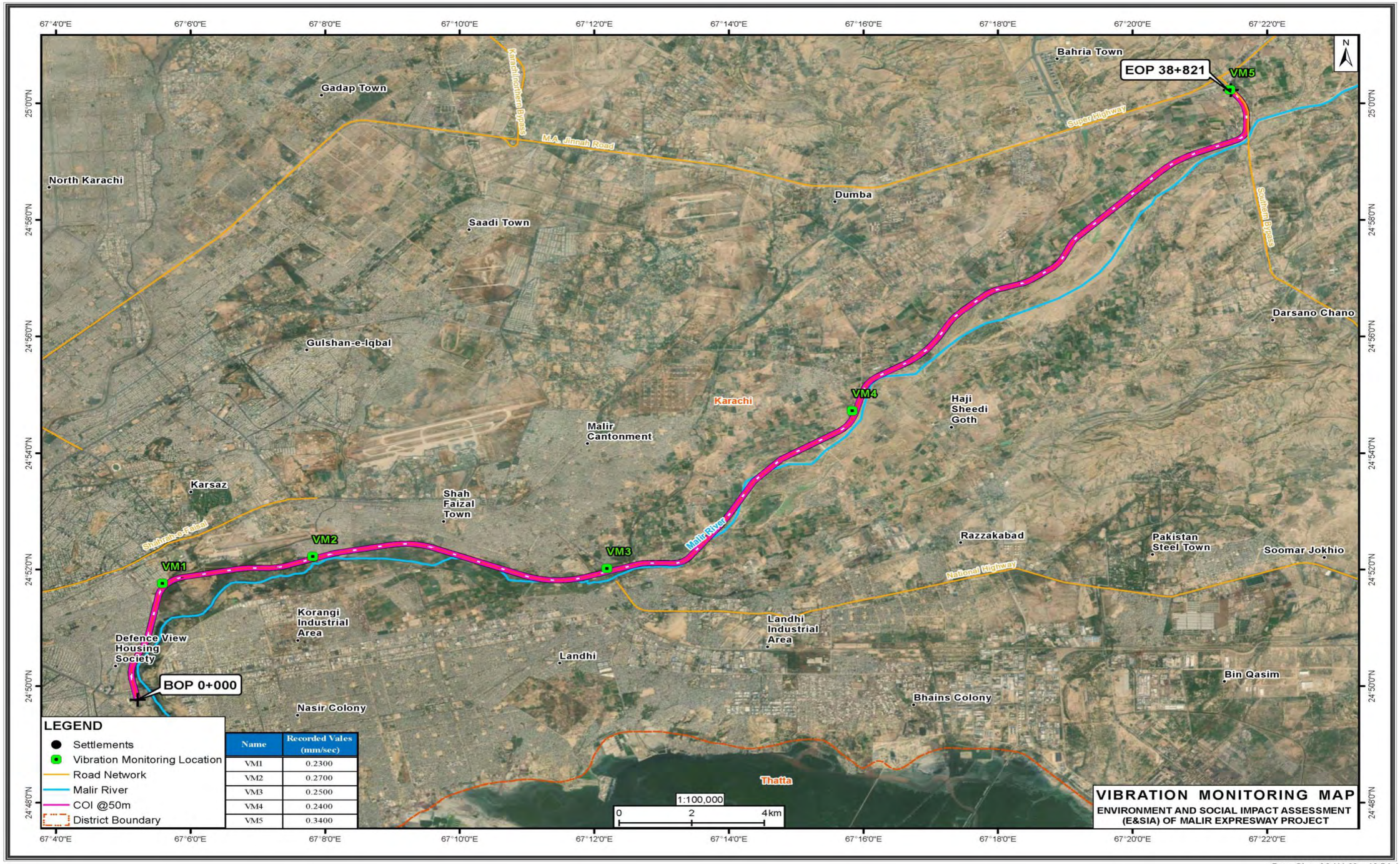

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Figure 7.3: Vibration Monitoring Map

Table 7.10: Baseline Vibration Monitoring Results

Sr. No.	Monitoring Location	24hr Monitoring Results (mm/sec)
1	AN1 (24.8320, 67.0870)	0.23
2	AN2 (24.8704, 67.1302)	0.27
3	AN3 (24.8670, 67.2031)	0.25
4	AN4 (24.9121, 67.2639)	0.24
5	AN5 (25.0039, 67.3575)	0.34

523. The vibration measurement results are within the expected range (as mentioned in **Table 7.11**) for the monitoring locations and the maximum vibration levels recorded are consistent with moving vehicles near the measurement location. This impact can be categorized as direct, medium, site-specific, short term, temporary, medium probability and reversible.

Mitigation Measures:

- Vibration measurement during construction phase by the contractor near the settlements/sensitive receptors in COI along the proposed MEX alignment.
- Vibration monitoring of existing operations or construction activity can range from simple, single-location measurements to more complex, simultaneous, multi-instrument measurements. The simple approach consists of taking measurements at the most sensitive location along the MEX or the location perceived by the complainant to have the worst level of vibration. This information can be used to identify unusual conditions that may be contributing to the high vibration condition and to identify a course of action to reduce the impact;
- Timing of the construction works to be conducted during the recommended operational hours, to reduce vibration levels to residential properties;
- Residents to be pre-warned of high vibration events (e.g. piling operations), and any operations being undertaken outside recommended hours;
- The vibration from rolling and compacting activities would be considered intermittent and short-term, and likely to be tolerated if warnings are given to potentially affected residents. Residents would therefore be pre-warned of high vibration events (e.g. piling operations), and any operations being undertaken outside recommended hours. Public notification would be given a minimum of 72 hours prior to planned works. Residents would be made aware of the construction times and the duration they would likely be affected, through letter drops, personal meetings/phone calls as necessary; and
- The equipment operators to be made aware by the contractor of potential vibration issues problems and of techniques to minimize vibration effects during construction works.

524. Some typical methods for reducing vibration from construction activities are described below which may be applied for the MEX construction sites if required:

Wave Barriers:

525. The purpose of a barrier is to reflect or absorb wave energy, thereby reducing the propagation of energy between a source and a receiver. A wave barrier is typically a trench or a thin wall made of sheet piles or similar structural members. The depth and width of a wave barrier must be proportioned to the wavelength of the wave intended for screening. The wavelength of a seismic wave is a function of propagation velocity and frequency. Pile driving typically generates ground vibration with frequencies in the range of 4–30 Hz[35]. With common wave velocities in the range of 61–610 m/s, typical wavelengths can be in the range of 3–152 m.

Vibration Reduction for Impact Pile Drivers

526. Impact pile driving can be the most significant source of vibration at construction sites. The principal means of reducing vibration from impact pile driving are; Jetting; Predrilling; Using cast-in-place or auger cast piles; Using non-displacement piles; Using pile cushioning; and Scheduling for specific times to minimize disturbance at nearby vibration-sensitive sites. Some of these methods may not be appropriate in specific situations, but where they are practical, they can often be used to reduce vibration to an acceptable level.

Vibration Reduction Measures for Other Construction Equipment

527. In most cases, vibration induced by typical construction equipment does not result in adverse effects on people or structures. Noise from the equipment typically overshadows any meaningful ground vibration effects on people. Some equipment, however, including vibratory rollers and crack-and-seat equipment, can create high vibration levels.

528. Because of the nature of these types of devices, the options for reducing vibration are limited. Maximizing the distance between the source and receiver might be possible, but there is usually little or no flexibility in this regard. Conducting work when most people are not in the area (e.g., at work) or when sensitive equipment is not operating can avoid or minimize adverse impacts with this type of equipment, but pavement crack-and-seat operations often must be conducted at night to avoid disrupting traffic. As such, little can be done to avoid adverse impacts on people.

Vibration Reduction for Construction Vehicle Operations

529. Construction Vehicles traveling on a smooth access routes are rarely, if ever, the source of perceptible ground vibration. However, discontinuities in roadway/access routes pavement often develop as the result of settling of pavement sections, cracking, and faulting. When this occurs, construction vehicles passing over the pavement discontinuities impart energy into the ground, generating vibration. In most cases, only

[35] Transportation and Construction Vibration Guidance Manual, California Department of Transportation, 2013

heavy trucks, not automobiles, are the source of perceptible vibration. Trucks traveling over pavement discontinuities also often rattle and make noise, which tends to make the event more noticeable when the ground vibration generated may only be barely noticeable.

530. Because vibration from vehicle operations is almost always the result of pavement discontinuities, the solution is to smooth the pavement to eliminate the discontinuities. This step will eliminate perceptible vibration from construction vehicle operations in virtually all cases.

7.5.2.8 Soil Contamination

Potential Impact

531. Construction activities such as clearing of earth, levelling, compaction, carpeting, pavement finishing will affect the existing soil condition in the CoI. During the rain, the eroded soil can mix with stagnant water to transform into slush, which can affect movement of vehicles and machinery and construction work as well as limit the movements of local people.

532. Heavy metals, oils, other toxic substances and debris from construction traffic and spillage may be absorbed by the soil at construction sites and get carried with runoff water to Malir River. This process may trigger during the monsoon season when construction is in progress.

533. Whereas contamination of soil may be caused by oil and chemical spills at asphalt plant sites, workshop areas and equipment washing yards. This impact is, however, of temporary, site specific and low negative in nature.

Mitigation Measures

- All spoils should be disposed of at site designated by Karachi Metropolitan Corporation (KMC) or concerned department and the site should be restored back to its original conditions. Soils with hazardous waste leaks should be dealt with by SEPA certified contractors;
- Non-bituminous wastes from construction activities should be dumped in approved sites, in line with the legal prescriptions for dumpsites, and covered;
- Soil contamination by asphalt should be minimized by placing all containers in caissons;
- The Contractors will be required to instruct and train their workforce in the storage handling and management of materials and chemicals that can potentially cause soil contamination;
- Material Safety Data Sheets (MSDS) will be strictly followed during handling and storage of chemicals;

7.5.2.9 Soil Erosion

Potential Impact

534. The construction of proposed MEX may create numerous roads cut and fill embankments along the alignment, as well as ditch relief or culvert sites that may contribute to runoff and high sediment production that can cause land degradation. Road cut and fill embankments have bare and steep gradients that cause the generation of runoff and sediment yield. Lack of vegetation cover also intensifies soil detachment by raindrops and proliferates susceptibility to erosion because of reduced cohesion and shear strength of the soil. Similarly, steep gradients increase erosion on these slopes due to reduced water infiltration and increased runoff accumulation.

535. Moreover, construction activities such as clearing of earth, levelling, compaction, carpeting, pavement finishing will affect the existing soil condition in the CoI. The clearing of vegetation can also loosen the soil and make it more susceptible to erosion due to wind and rain. There is also a possibility of silt runoff during the monsoon causing soil erosion.

536. Soil erosion may also occur in the workshop areas because of improper drainage system of equipment washing yards and improper management of construction activities. This impact can be categorized as indirect, moderate, site-specific, long term, permanent, medium probability and irreversible.

Mitigation Measures

537. The contractor should adopt good engineering practices that will help to control or minimize the soil erosion both at the construction sites and in peripheral areas. All the disturbed areas need to be protected against soil erosion by stripping and stockpiling of all the available topsoil for later re-vegetation. Special slope protection measures will be adopted in the sensitive areas and along the shoulders of proposed MEX alignment.

538. It is suggested that the following provisions may be made in the design:

- Provision for vegetation with a fast-growing crop and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization; and
- Use of stone pitching or riprap will also be provided in the design at appropriate places especially around flyovers, bridges and culverts in the MEX alignment. Provision for rip-rap in discharge zones from drainage structures may be made in the design to reduce erosion; and
- Down drains/chutes may be lined with rip-rap/masonry or concrete to prevent erosion. Side slopes may be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion.

539. Amongst all the above-mentioned control methods, vegetation cover is probably the most widely used measure for controlling erosion on roadside slopes and is therefore strongly suggested for the proposed Project. This is because vegetation cover intercepts rainfall and increases water infiltration, stabilizes the soil with roots that hold soil particles together. Sediment and fine debris will be removed as solids by cleaning/scraping work

areas and removing piles of debris in a solid form, to prevent sediment loss to drainage channels.

540. Site restoration plan for the proposed Project should also be strictly followed. This needs to be ensured by contractor.

7.5.2.10 Wastewater Generation at Construction Camps

Potential Impact

541. Total three (03) construction camps are proposed to be established during construction period for the subject Project. The locations of construction camps have been provided in **Chapter 3** which has been identified as per construction camp criteria laid down in EIA report.

542. Wastewater will be generated at the construction camps and from construction activities. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as canals, Malir River, apart from soil contamination. Water from dewatering activities (during rainy season) has the potential to contain suspended solids and oil and grease and if disposed of untreated, may affect the soil quality. The **Table 7.12** below shows anticipated composition and estimate of the wastewater to be generated during the construction phase of the Project assuming that on average the water demand per person is 40 liters per day and that 80% of the water demand will become wastewater.

Table 7.11: Estimated Wastewater Generated by Workers in Construction Camp

No. of Workers*	Estimated Total Water Demand** (liters/day)	Estimated Wastewater Generated (liters/day)***
900	36,000	28,800

* Refer Table 3-7 “Estimated Work Force Requirements”
** = (900) x (40) = 36,000 liters/day
*** = 36000 (80%) = 28,800 liters/day

543. This 28,800 liters/day of wastewater is from the whole (03) nos. of construction camps while the wastewater quantity for each camp will be much less. This impact can be categorized as direct, moderate, site-specific, short term, temporary, medium probability and reversible.

Mitigation Measures

544. To dispose the liquid waste generated from the construction activities, the following steps will be taken by the Contractor:

- Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks (as shown in **Figure 7.5).** Proper monitoring to check the compliance of SEQS will be carried out;
- Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit;

- Construction yards and material storage areas where vehicles operate or materials are stored should be established on well drained fill;
- Free-flowing points of discharge for storm water should be identified nearby the boundaries of materials storage/construction yards for gravity or pump-assisted dewatering and yard drainage;
- Local drainage channels should have sufficient capacity for handling discharge flows, with clear discharge points to open drainage courses;
- Water discharged to constructed drains should contain a minimum quantity of suspended solids;
- Drainage from fuel storage tank locations, refuelling areas, and equipment service areas should be segregated from other runoff; discharge should be routed through an oil/water separator; and
- Contractors will be required to observe drainage conditions during dewatering operations and storm events to assure positive drainage. If flooding occurs along roadways or in neighbourhoods, or community complaints arise, the contractor will undertake a combination of the above mitigation measures to minimize drainage and water quality impacts.

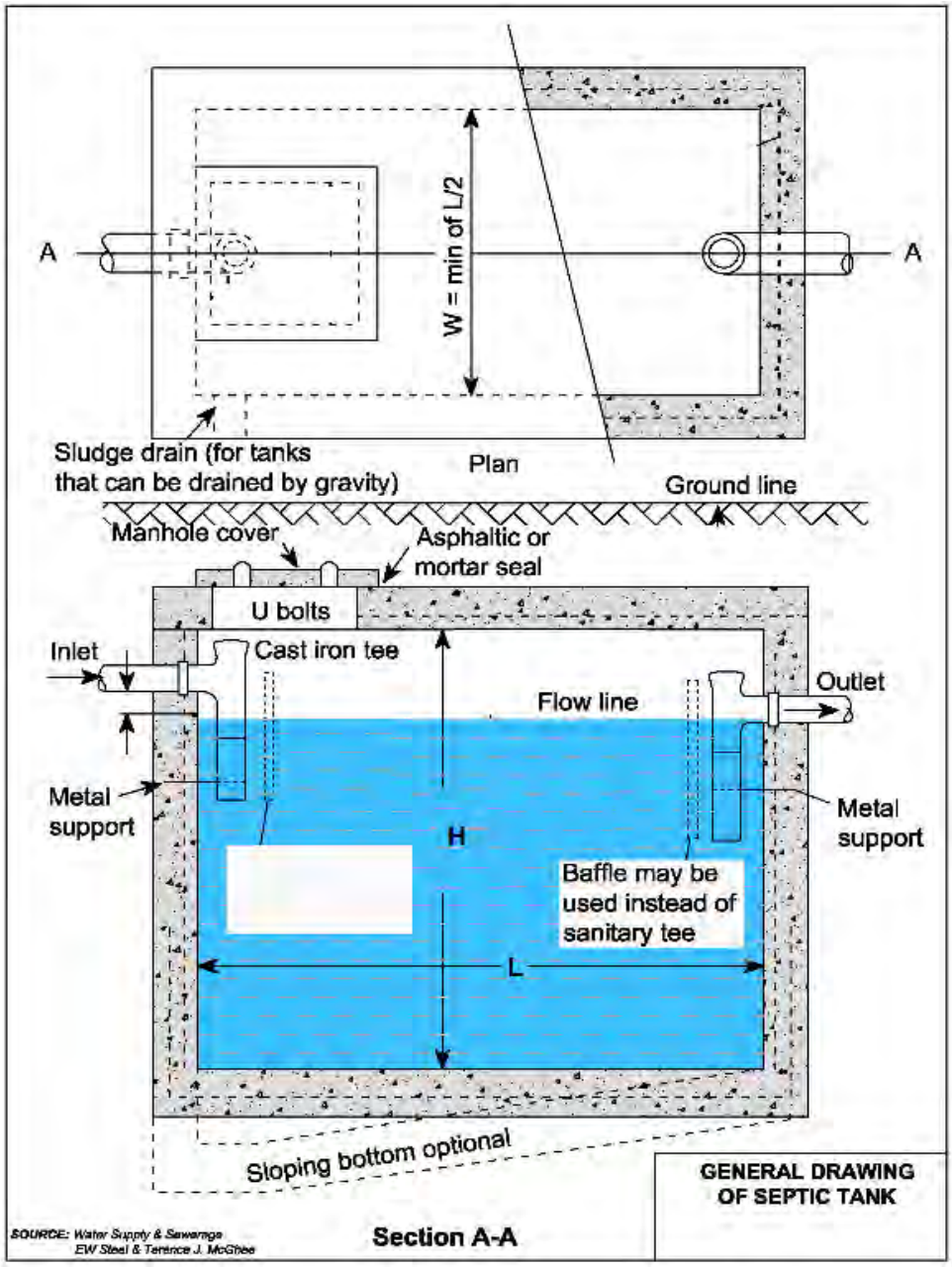

Figure 7.4: General Drawing of Septic Tank

7.5.2.11 Solid Waste Generation at Construction Camps

Potential Impact

545. Considering the laborers (about 900 in numbers) residing in the construction camp and the locally available labor, an average solid waste generation rate of 0.5 kg/capita/day[36] is adopted for the estimation of solid waste generation. Based on this assumption, a total of about 450 kg of solid waste will be generated from construction camps on daily basis. The major components of the labor camp waste will be garbage, organic waste, rubbish

Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day.

and small portion of ashes and residues. Other type of wastes may include inorganic construction wastes including hazardous waste. These wastes will be generated due to the construction activities and the materials used for construction. This waste would require proper disposal to minimize land and water contamination. This impact can be categorized as direct, moderate, site-specific, short term, temporary, medium probability and reversible.

Mitigation Measures

- All the solid waste from the camps will be properly collected at source by placing containers and disposed of through proper solid waste management system. The Contractor will coordinate with local representatives and administration concerned department for the disposal of solid waste;
- The concerned department must develop a plan of action for transporting the waste to the disposal site for final disposal. It is the responsibility of the concerned department to ensure that the disposal site is properly lined to prevent the leachate from contaminating the groundwater;
- Toxic waste will be handled, stored, transported and disposed separately by SEPA certified contractors;
- The waste will be properly sealed in containers with proper labels indicating the nature of the waste;
- Solid waste will be segregated at source so that it can be re-used or recycled; and
- Contractors are required to prepare a Solid Waste Management Plan that identifies the following: material types, estimated quantities and methods for disposal; locations onsite for collection and storage; locations for disposal. A recordkeeping system for all wastes and a tracking and manifest system for hazardous and recycled materials will be included in the plan. Necessary enclosed facilities, containers and equipment will be provided in keeping with the Plan. The Plan should be updated as necessary with actual quantities, locations for disposal and additional information in accordance with the Plan.

7.5.2.12 Waste Generation at Construction Site

Potential Impact

546. The construction waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials etc.). The handling and storage of oil and other hazardous waste will be a source of environmental pollution during the excavation, foundation, levelling, carpeting and pavement activities. The solid and liquid waste from the batching plan setup in the vicinity of construction camps may also generate along with the above waste stream. The quantification of construction material waste is not available, but it is anticipated that less amount of such waste will be generated along the route length.

547. Improper disposal of construction waste can lead to nuisance and hazards towards environment and local population. The unspent materials and debris produced from consumed up materials, if left as such and allowed to mix with soil underneath, can degrade the quality of receiving soils and render them unfit for plantation. Leakages of oils, lubricants, chemicals, and other similar substances from their storage sites can

spoil the receiving soils and may undermine ability of the spoiled soils to support growth of vegetation and plants. This impact can be categorized as direct, moderate, site-specific, short term, temporary, medium to high probability and reversible.

Mitigation Measures

548. Mitigation measures will include:

- Waste Management Plan will be developed to implement an efficient and responsive solid waste management system during construction phase. Recyclable wastes e.g. steel bars will be sold to waste vendors;
- The contractor will develop specific environmental management plans for asphalt plants and concrete batching plants. These plans will incorporate the general measures as applicable to the entire Project, but will also have focused mitigations for solid waste from these plants;
- Reusable material will be used as a filling material during ground levelling;
- Solid waste generated during construction will be safely transferred to the designated waste disposal sites of Karachi (specifically Malir District) after getting the prior approval from the KMC and the approved contractor will provide a proper waste management plan for safe transfer as well as disposal of this waste; and
- The site will be restored back to its original conditions after construction completion.

7.5.2.13 Borrow Pits

Potential Impact

549. Borrow/ open pits and its excavation activities may result in land disputes, soil erosion, loss of vegetation, landscape degradation, and damage to road embankments.

550. Borrow pits may also result in potential sources of mosquito breeding and may prove hazardous to human beings. This will also degrade the hygienic condition of the Project Area. A *Quarry Management Plan* is attached as **Annex-XX**. This impact is permanent and moderate adverse in nature.

Mitigation Measures

551. Mitigation measures will include:

- It is suggested that during the planning stage of quarry development the groundwater level be defined so the quarry floor can remain at least 2 meters above groundwater;
- In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1:4;
- No extraction to be carried out from Malir river bed, and instead authorized borrow pits be used
- Soil erosion along the borrow pit will be regularly checked to prevent/ mitigate impacts on adjacent lands;
- Plan sequencing of both quarrying and rehabilitation for the life of the quarry;

- Prior to the commencement of a quarrying activity the type of vegetation should be agreed with the landowner and should be consistent with the proposed final land-use.

7.5.2.14 Impact on Water Resources (Surface and Groundwater Contamination)

Potential Impact

552. The proposed Project will pass along the Malir River and cross four (04) numbers of nullahs including one Malir River tributary, along with numbers of sewerage and storm water drainage outlets/network at different locations. Bridges are proposed on these nullahs which may get contaminated by fuel and chemical spills, or by solid waste and effluents generated by the kitchens and toilets at the construction camp sites if found its way to these water bodies.

553. Surface water might also get contaminated due to the disposal of construction waste generated during the Project activity at these water bodies, which will result in jeopardizing the health of locals that use this water for meeting domestic requirements. The impact on these water bodies will be only for the period of construction and will eliminate as the construction work is over. In addition to that, construction waste, if left unattended will result in forming leachate which may percolate through the soil strata and will reach underground water table and hence, will end up contaminating it. This impact can be categorized as direct, moderate, local, medium term, temporary, medium probability and reversible.

Mitigation Measures

554. As a mandatory step, all the effluents will be disposed as per the requirements of SEQS. Moreover, to reduce the risk of surface and groundwater contamination, good management practices will be adopted to ensure that fuels, chemicals, raw sewage, and wastewater effluent are disposed of in a controlled manner. These measures are described below:

- Construction camps will be established in areas with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that SEQS are met;
- The surface and groundwater reserves will be adequately protected by installing screens and barriers to protect the source of contamination such as construction and oily waste that will degrade its potable quality;
- The proponent will ensure that the construction work is confined within the RoW and water bodies are prevented from pollution during construction;
- The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic requirements;
- Regular water quality monitoring according to determined sampling schedule;
- The contractor will ensure that construction debris do not find their way into the rivers, drainage or irrigation canals which may get clogged;
- To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like drainage structures in urban areas;

- Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond;
- Construction work close to the streams or other water bodies will be avoided, especially during monsoon period; and
- Wastes will be collected, stored, and taken to approved disposal site through specified contractors;
- Wastewater effluent from the Contractors' workshops and equipment washing-yards will be passed through adequate treatment facilities e.g., septic tanks, gravel/sand beds to remove oil/grease and other contaminants before discharging into the natural streams. According to the SEQS, the BOD concentration in sewage must be brought down to less than or equal to 80 mg/l before being discharged into a natural stream having capacity to dilute the effluent.

7.5.2.15 Flora

Potential Impacts

555. Tree growth in the Project Area and the study area is scattered and scanty. Therefore, the impact shall also be proportionately low. During the entire construction period dust laden polluted air will form a dust film on leaves thus blocking the stomata consequently hindering photosynthesis processes causing detrimental effect on the plant health.

556. Exhaust of noxious gases from movement of heavy machinery and dust will pollute air which will adversely affect health and vigor of plants. During construction activities the Contractor's workers may damage the vegetation and trees (for use as firewood to fulfill the camps requirements). Removal of trees shall have an adverse effect on the ecological habitat of the Project Area. This impact is direct, regional, permanent, irreversible, possible, and medium significant.

Mitigation Measure:

- Cutting of trees and disturbance of orchards shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized.
- Utmost effort shall be made to save as many trees as possible and minimize the loss of vegetation.
- An awareness campaign targeted on the neighborhood farmers should be run to popularize the planting of trees species especially recommended in tree plantation plan/reforestation plan provided in the **Annex-XV**.
- The contractor's staff and labor should be strictly directed not to damage any vegetation such as trees or bushes. They should use the paths and tracks for movement and should not be allowed to trespass through farmlands;
- Construction vehicles, equipment and machinery should remain confined within their designated areas of movement;
- Contractor should supply gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel should not be allowed; and
- Camp sites and asphalt plants should be established on waste/barren land rather than on forested or agriculturally productive land. However, if such type of land is not available, it should be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to the trees.

7.5.2.16 Fauna

Potential Impacts

557. During construction phase the existing population of mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving excavation, blasting, movement of machinery and vehicular traffic, movement of labor, camping, etc. The existing animals will leave the directly affected areas due to construction activities and anthropogenic intervention. Some animals particularly reptiles may get killed during the earthwork's operations. Moreover, the movements of the mammals and reptiles will be restricted during the construction phase.
558. Birds as well will tend to move away from the construction areas and find shelter and food elsewhere due to the activities mentioned above for fear of being hunted / trapped.
559. Noise generated from blasting and machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Uncontrolled blasting may even disturb the wildlife of the Project Areas. Food and refuse at the Contractor's camps may attract animals that might in turn be hunted by the workers. This impact is indirect, site-specific, temporary, reversible, possible, and medium significant.

Mitigation Measure

- New and good condition machinery with minimum noise should be used in construction;
- Contractor should ensure that the no hunting, trapping of animals should be carried out during construction;
- Borrow pits should be fenced so that no animal can fall into these;
- The camps should be properly fenced and gated to check the entry of wild animals in search of eatable goods. Similarly, waste of the camps should be properly disposed of to prevent the chances of eating by wild animals, which may prove hazardous to them; and
- Special measures should be adopted to minimize impacts on birds such as avoiding noise generating activities during the critical period of breeding.
- Shooting, hunting, trapping, or poaching of animals and birds should totally be banned within the Study Area, to minimize loss of fauna ecosystem. Implementation of such a policy will be the sole responsibility of concerned Government Departments.
- Care shall be taken during construction activities for avoiding purposely or chance killing of animals.
- If found any wild species or habitat during construction, it must be dealt with carefully and local wildlife department officials should be called.
- Hunting, poaching, and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labor force accordingly and clear orders should be given in this regard.
- The Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department.
- Special measures shall be adopted to minimize impacts on wild birds, such as avoiding noise generating activities during the critical periods of breeding.

- Blasting and other noise generating activities shall not be carried out during the night by the work force, clear orders should be given.
- Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them.

7.5.2.17 Agriculture, Orchards and Trees

Potential Impact

560. The alignment of the proposed Project is also falling in agricultural area and damages of crops orchards and tree are expected during construction activities. Following activities shall result in the loss of agricultural land:

- Construction of main road, interchanges, installation of fence and allied structures;
- Construction of haul routes;
- Construction in the Project Area.

561. The areas used for the construction of haul routes and camps will result only in temporary loss of cultivatable land, as the land can be again brought under cultivation following completion of the construction works. However, standing crops and orchard in RoW of the road will result in permanent loss of cultivatable land. The impact on agriculture in the Project Area is major adverse in the short term and permanent.

Mitigation Measures

- To reduce the loss of agricultural land during the construction stage, existing haul routes will be preferred by the contractor, and the width of any new haul route shall be limited to the bare minimum required and approved by the engineer; and
- Removal of all contractors' facilities from the Project Area shall be a contractual requirement, and as such the land used for the sub-camps can be restored to facilitate agriculture and the land used for the construction camp shall become cultivatable.
- Compensation for the loss of crops to the landowners and cultivators will be paid, in accordance with the prevailing market prices and uniformity in rates will be ensured within the local areas;
- As far as possible, land within the RoW (which will be acquired) or otherwise barren land without any crop outside the RoW will be selected for the camp sites and disturbance to the crops and natural vegetation will be avoided as much as possible.

7.5.2.18 Impact on Protected Areas

562. In Pakistan, the protected areas are classified into three main categories viz., Wildlife Sanctuaries, National Parks and Game Reserves. In the Project corridor, no such site exists and therefore, no impact on protected areas is envisaged due to construction of Malir Expressway.

7.5.2.19 Aquatic Fauna

Potential Impact

563. To define the categorization of aquatic habitat extensive literature review supported by focus group discussions, stakeholder consultations, field observations/verifications and GIS mapping was carried out. Based on the ground realities and values, there are two types of fish species (see **Figure 5.5**) that has been reported during the site survey and during the consultation with the Office of Director Marine Fisheries. These are **Tilapia (Oreochromis mossambicus)** and **Channa punctata.** The details of these species are under **Section 5.5.6**.

564. Furthermore, the Malir river is a non-perennial river which mostly caters the wastewater from the various point and non-point sources. The quality of Malir River is degraded to the point that it does not support any critical aquatic life including zooplanktons. In addition to that, the identified species commonly survive under harsh conditions (deteriorated water quality). Hence, there is no direct significant impact on aquatic life of Malir River in the Project Area vicinity.

Seasonality

565. There are two main seasons in Karachi, summer and winter. Spring and autumn seasons are very nominal. The Malir River upstream of the Project Area generally remains dry due to drought and barani small dams (Mol Dam, Sukhan Dam, Mir Chakar Dam, Konkar Dam, Malir Bukhsan Dam, etc.) in its catchment area. These small dams receive the rainwater of the catchment area.

566. The Malir Dam regulates flow and flooding of the river, preserving a reservoir during seasonal droughts. The river of the Project Area receives mostly the industrial and urban sewage water which is highly polluted and unable to survive fish /aquatic life except some plants / bacteria and two types of fish (Tilapia and Channa punctata). So as the seasonality effects of the river on aquatic ecology are concerned, these are not significant.

567. During the survey and study of the Malir River in the Project Area two fish species and marshy grasses were identified which may be affected by the adverse impacts of the proposed Project if proper mitigation measures are not ensured. These impacts are summarized in **Table 7.13**.

Table 7.12: Seasonal Impacts on Aquatic Environment

Sr. No.	Season	Impacts on Aquatic Environment	Impact on Aquatic Species
1.	Summer	Early summer will increase pollution level in the river water/depression/pools due to dry season and high ratio of industrial water.	The highly polluted water will have direct adverse impact on the aquatic life in the Project Area. During rainy season, if water is retained by the expressway, it will

Sr. No.	Season	Impacts on Aquatic Environment	Impact on Aquatic Species
		In late summer/rainy season, rain water of the catchment area in the Project Area will be detained due to the expressway and ratio of industrial water will definitely be increased. The high temperature of the season will rise decomposing of organic material causing harmful effect to the aquatic life.	impact on the fish species by increasing salinity and pollution level.
2.	Winter	Low temperature will slow down the decomposing activities in water and peripheral water of the pools in the river will become less polluted. It will give relief to the anaerobic aquatic life.	It will have no impact on aquatic life due to low level of decomposing of organic matter and pollution material. Channa species will hibernate under mud in marshy places.
3.	Autumn	Medium temperature of the season will be less harmful for the aquatic life.	This is the breeding season of both the fish species Tilapia & Channa. Breeding will be affected if pollution level increases due to blockage of sewage / rain water by the proposed Expressway.
4.	Spring	Medium temperature of the season will be less harmful for the aquatic life.	This is the breeding season of both the fish species Tilapia & Channa. Breeding will be affected if pollution level increases due to blockage of sewage / rain water by the proposed Expressway.

Mitigation Measures

568. Proper arrangements must be made to control the wastes from machinery & equipment used at site during the construction phase.

569. Channa punctatus, the fish species in the Project Area require the salinity level less than 10 mg/liter for its survival and proper growth. Increase in the salinity level will stop its breeding activities and the biodiversity will disturb. Construction of proper culverts for free flow of the rain and sewage water is strongly recommended to maintain the aquatic biodiversity in the area, which has already been incorporated into the design with the addition of numerous box and pipe culverts.

7.5.2.20 Discovery of Heritage Sites and Structures during Excavation

Potential Impact

570. During excavation, there is a chance of finding artifacts. In case of finding any artifact, the contractor shall immediately report through Supervision Consultant to Directorate General (DG) of Archeological Department, Government of Sindh to take further suitable action to preserve those antiques or sensitive remains.

Mitigation Measures

- Client or the contractor should acquire an approval from the concerned department prior to construction;
- Contractor should strictly follow the submitted work plan in order to avoid traffic problems;
- Alternate route should be assigned for the people going towards these historical and cultural places during public holidays;
- Alternate construction methods should be used, if deep excavations pose threat to existing structures;
- Construction Machinery that produces less noise and vibration should be used along these sites;
- Ensure regular sprinkling of water in all active construction areas near cultural and heritage sites;
- Follow steps mentioned in a *Chance Find Procedure* (attached as **Annex-XVI**) in the event, if any unknown cultural heritage is found during any excavation activity;
- Contractor should ensure that the chance find procedure is communicated to the construction contractor prior to start of Project.

7.5.2.21 Social and Cultural Conflicts

Potential Impact

571. During the construction phase of the Project, conflicts may arise between labor force and local community. Use of local resources and products by the construction workers can generate stress on the local resources. Furthermore, difference in cultural values may also cause discomfort to residents. This impact is negative, local, low, short-term, and probable.

Mitigation Measures

- Local labor especially from nearby communities should be given preference for the construction works;
- Careful planning and training of work force to minimize disturbance to the local people;
- Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals; and
- Adequate training for the transitive workforce of the project (involved both in the construction process and in the commissioning) to regard the customs of the area so that the locals do not feel insecure.

7.5.2.22 Employment

572. Due to construction of the proposed Project, economic and commercial activities will be generated in the study area, as the laborers and semi-skilled staff from nearby communities will have an opportunity to work for the construction of the proposed Project. Similarly, the restaurants, hotels, and tea stalls present in and around the proposed Project Area will also get benefits in an income generation, as workers will visit them for food. The impact is temporary and positive in nature.

7.5.2.23 Impacts on Livelihood

Potential Impact

573. The construction activity may disturb the business and livelihoods of the shopkeepers and workers doing their businesses along the alignment due to the project activities. In this respect, the most critical areas include Azeempura, Juma Goth, Magsi Goth, Samoo Goth, Bachal Bagh and near M-9 Toll Plaza. The main commercial activities in these areas include vegetables shops, grocery stores, workshops, and service stations. At this stage the assessment of livelihood impacts has been carried out based on the alignment and proposed construction camps. During the construction phase, these locations will be finalized and on that basis the livelihood impacts will be determined more accurately.

Mitigation Measures

- Proper compensation should be provided to all the affected losing their livelihoods along the route;
- Relevant stakeholders should be engaged to design livelihood restoration measures including affected of the proposed Project Area;
- Livelihood restoration plan in LARP will be provided to mitigate the adverse impacts on livelihood and restoration of commercial activates will be monitored;
- Project Construction should be completed on time; and
- Proper awareness and training should be conducted among the affected regarding Project benefits, reasons for acquiring lands and compensations to be provided.

7.5.2.24 Health Impacts (Communicable Diseases)

Potential Impact

574. The health impacts that are envisaged to take place among employees, workers and local population of the proposed Project are discussed below:

Communicable Diseases

575. For the implementation of Project activities, skilled and unskilled labor is required by the contractor. Mostly, skilled, and unskilled workers will be hired by the contractor on permanent and contract basics, belonging to different cultural backgrounds, which they utilize for different developmental projects. In this case, occurrence of communicable diseases like HIV/AIDs, COVID-19, respiratory diseases, and skin and eye infections

are communal to take place during the execution of the proposed Project. This impact is negative and moderate in nature.

Mitigation Measures

- Proper checkup of skilled and unskilled workers before their hiring;
- Labor camp should be away from the residential area and workers' management plan should be formulated by Contractor to minimize the adverse impacts on local communities and workers;
- Trainings, and awareness campaigns should be conducted for workers and surrounding communities on awareness and prevention of HIV/AIDs and COVID-19. Guidelines to combat with COVID-19 are attached as **Annex-XIX**;
- Workers should be educated for personal hygiene and the sanitation concerns, leading to communicable and non-communicable diseases;
- Water should not be allowed to stagnate even if clean, and measures should be taken to cover the area; and
- Insecticides should be periodically sprayed.

7.5.2.25 Influx of Labor

Potential Impact

576. For the implementation of Project activities, skilled and unskilled labor is required by the contractor. Mostly, skilled, and unskilled workers will be associated with the contractor for long period of time, where they are required for the projects, and while other workers are hired from the different areas that belong to different cultural backgrounds. Social problems and conflicts that are associated with Labor Influx are as follows:

- Risk of social conflict: Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural, or ethnic differences, or based on competition for local resources. Ethnic and regional conflicts may be aggravated if workers from one group are moving into the territory of the other;
- Increased risk of illegitimate behavior and crime: The influx of workers and service providers into communities may increase the rate of crimes and a perception of insecurity by the local community. Such illegitimate behavior and crimes can include theft, physical assaults, substance abuse, sexual assault and human trafficking;
- Impacts on community dynamics: Depending on the number of incoming workers and their engagement with the host community, the composition of the local community, and with it the community dynamics, may change significantly. Pre-existing social conflict may intensify as a result of such changes;
- Increased burden on and competition for public service provision: The presence of construction workers and service providers (and in some cases family members of either or both) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education, and social services. This is particularly the case when the influx of workers is not accommodated by additional and separate supply systems;
- Increased risk of communicable diseases and burden on local health services: The influx of people may bring communicable diseases to the Project Area, including

sexually transmitted diseases (STDs), or the incoming workers may be exposed to diseases to which they have low resistance. Workers with health concerns relating to substance abuse, mental issues or STDs may not wish to visit the Project's medical facility and instead go anonymously to local medical providers, this can result in an additional burden on local health resources;

- Local inflation of prices, accommodations, and rents: A significant increase in demand for goods and services due to labor influx may lead to local price hikes and crowding out of community consumers. Depending on Project worker income and form of accommodation provided, there may be increased demand for accommodations, which again may lead to price hikes and crowding out of residents; and
- Increase in traffic and traffic related accidents: Delivery of supplies for construction workers and the transportation of workers can lead to an increase in traffic, rise in accidents, as well as additional burden on the transportation infrastructure.

577. This impact is negative and temporary in nature.

Mitigation Measures

578. Suggested mitigation measures for smooth execution of construction activities include:

- Labor camp(s) should be established away from residential population;
- Preference should be given to the local people to work with contractor, and contractor should hire maximum labor force from the Project Area because this will reduce the labor influx;
- Awareness should be created among the work force to ensure respect for local customs;
- Construction work should be completed within the stipulated time to move workers to next location;
- Labor force should be shuffled with the time;
- An effective GRM should be established for the Project to resolve all issues related to the community. Thus, progress regarding resolving the issues should be monitored closely;
- Create awareness among workers on proper sanitation and hygiene practices to endorse proper health and maintain good housekeeping practices at all Project sites;
- Provide adequate personal hygiene facilities in good condition with adequate supply of clean water;
- Make arrangements to treat the affected workers on time to control the movement of vector borne diseases;
- Sensitize workers and surrounding communities on awareness and prevention of COVID-19, HIV/AIDS and sexually transmitted infections (STI) through training, awareness campaigns and workshops during community meetings;
- Provide proper and free COVIID-19, HIV/AIDS and STI health screening and counseling for site workers and community members;
- Develop and enforce a strict code of conduct for workers to regulate behavior in the local communities;
- Take all sensible precautions to avoid illicit, vicious conduct by or amongst the Contractor's personnel, and to preserve unity and harmony, and protection of people and property on and near the sites;
- Prohibiting drugs, alcohol, weapons, and ammunition on the worksite among personnel;

- Site security preparations must be contained within the Bills of Quantities (BoQs) to avoid any delays which might be caused due to insecurity;
- Appropriate fencing, security check points, gates and security guards should be provided at the construction sites to ensure the security of all equipment, machinery and materials, as well as to secure the safety of site staff; and
- The Contractor must guarantee that good relations are maintained with local communities and their leaders to help reduce the risk of vandalism and theft.

7.5.2.26 Gender Based Violence (GBV)

Potential Impact

579. In the society, female plays important role in managing household as well as in income earning activities, but they face various challenges to get access to educational institutions and employment opportunities due to cultural bindings, economic vulnerability, and lack of facilities.

580. According to the Pakistan Demographic and Health Survey (PDHS), 2017-18, 28 percent of women of Pakistan age 15 to 49 have experienced physical violence, six percent have experienced sexual violence, and seven percent experienced violence during pregnancy. Three in ten women who have ever experienced physical or sexual violence sought help to stop the violence, yet 56 percent never sought help nor told anyone.

581. During survey, consultations with females were conducted at individual and at group levels to gauge their apprehension regarding the Project activities and suggestions to mitigate the relevant impacts. During gender consultations in the Project Area, it was narrated by the participants of the gender consultations that no gender based violence prevailed among them. Unequal distribution of work and unequal pay structure against same work leads to gender discrimination which may lead to gender based violence in future. Hence; during construction phase gender based violence might arise due to discrimination made against women by unequal work distribution and unequal pay structure. Men and women are equally supposed to apply for jobs related to Project activities. No discrimination will be made in this regard. However, sexual harassment against women might occur because of mixing of men and women at the construction site, and moving on the roads, bus stops and markets. Educational institutions near the Project alignment are also sensitive regarding gender issues because mobility of female students and female staff may be disturbed due to labor force indulging in construction work. This impact is negative in nature during construction stage.

Mitigation Measures

582. With the effective measures and monitoring, the risk of gender based violence could be minimized by adopting the following mitigation measures:

- Awareness should be created among the females at individual and community levels about the constructions sites;

- During the timing of educational institutions workers should not be allowed to crowd in the surroundings;
- Alternative routes for pedestrian should be provided to avoid mixing of women with workers;
- Gender protection act should strictly be enforced during the construction activities in the Project Area, and monitor the implementation through field staff and district level structure;
- Raise awareness among the communities of the potential risks of GBV, and establish response services in the communities that can respond to instances of GBV (particularly those related to issues of labor influx);
- The Contractor should make sure that no discrimination is made based on gender while hiring of workers. Complete SOPs should be formed and implemented by the contactor regarding working women at site. Implementation on these SOPs should be monitored by the implementation Consultants.
- Provisions of gender disaggregate bathing, changing, and sanitation facilities; and
- Contractor should take proper measures to address and resolve issues relating to harassment, intimidation, and exploitation, especially in relation to women.

7.5.2.27 Child Labor

Potential Impact

583. There are two basic conventions on child labor adopted by the ILO, and one adopted by the United Nations. The ILO Minimum Age Convention, 1973 (No. 138) and its accompanying Recommendation (No. 146) set the goal of elimination of child labor, and the basic minimum age for employment or work (in developing countries at 14 years of age or the end of compulsory schooling, whichever is higher; and 15 or the end of compulsory schooling for developed countries). The Convention sets a minimum age of 2 years younger for "light work," i.e., 12 and 13 years, respectively; and a higher minimum age for dangerous or hazardous work (basically 18 years of age, but 16 in certain circumstances). The Convention also has various other flexibility clauses.

Minimum Age for Employment or Work

(i) Ensure that child labor contrary to the convention is not used
(ii) Define child labor as any work done by anyone under 14 years old, except for light work done by children 12 years and older.
(iii) Ensure that no work is done by anyone of less than the school-leaving age, at least if schooling is available.
(iv) Ensure that no work is likely to jeopardize the health, safety, or morals of young persons, either by its nature or the circumstances in which it is carried out, is done in the Project by anyone under 18 years of age.

Forms of Child Labor

(i) Ensure that "worst forms" of child labor—for anyone under 18 years of age—are not used under any circumstances.

(ii) Direct activities to take immediate and effective measures to eliminate these worst forms of child labor.[37]

584. Inhabitants of the Project area have mix economic background and different sources of income. Children of low-income groups mostly involve themselves in different earning activities, as their parents prefer to get their children hired in small shops as helpers, and waiters in hotels for earning money, and supporting household livelihoods. However, the Sindh Restrictions on Employment of Children Act, 2017 prohibits the employment of children and restricts the employment of adolescents in certain occupations and processes such as construction industry, where whoever employs or permits a child (person under the age of 15 years) to work in an establishment shall be liable to punishment with imprisonment.
585. The child labor impact might arise during construction stage, as large number of skilled and unskilled labor will be required by the contractor for the construction activities of the proposed Project.

Mitigation Measures

586. The chance of hiring of underage workers for the Project activities will be minimized by adopting the following mitigation measures:

- Awareness should be created among the local communities about the adverse impacts of child labor. For the public awareness, meetings should be held in the Project Area, and announcements should be made using the available local platforms with the involvement of all sectors of the society;
- Contractor through contractual agreement should be bound to follow the labor standards, rules, and regulations during hiring the labor force. All activities should be monitored by the social and environmental staff of the implementing agency;
- Client and Supervision consultant should ensure that contractor shall have its employment policy in accordance with relevant act and labor policies in Sindh and Pakistan; and
- Contractor should ensure the presence of all persons at site are adults and have their proper identity cards with them.
- Reduce the health hazards and dangers to young persons in the workplace.

7.5.3 Anticipated Impacts during Operational Phase

587. The anticipated impacts related to the proposed Project have been studied for the operational phase and discussed hereunder.

7.5.3.1 Air Quality (Air Dispersion Modeling Through CALRoads)

Potential Impact

[37] *ILO Core Labor Standards-Handbook*

588. Reduction in traffic on inner city roads by the provision of this expressway will help[reduce air emissions from cars that take longer to get to their destinations through these congested routes. There will still be emissions released from vehicles when they use this expressway. To estimate the concentrations of the above pollutants in the ambient air, Air Dispersion Modeling (ADM) is carried out by using CALRoads View Version 6.5 by Lakes Environmental (CALINE 4: *The model uses traffic emissions, site geometry and meteorology to predict air pollutant concentrations near roadways. Predictions can be made for carbon monoxide, nitrogen dioxide and suspended particles*) for the proposed Project with an objective to determine the concentrations of CO, NO_2, and PM to assess the impacts on receptors. Air dispersion modeling is an important tool used to predict ambient air quality concentrations based on air pollutant emissions from vehicles. It utilizes the mathematical formulation to describe the atmospheric process that disperse the pollutant and determine the ground level concentrations to assess the impacts on different receptors. In impact assessment studies, the models are typically used to determine whether proposed facilities will be following national ambient air quality standards and offer the advantage of bringing about necessary changes in the proposed industrial facilities so that plans can be fine-tuned to minimize environmental impacts.

589. The ADM was carried out for 1st year of operation and 20th year of operation of proposed traffic projection for the estimation of the concentrations of CO, NO_2, and PM in the ambient air based on the design data based on Final traffic estimations. The input data for assessment of CO, NO_2, and PM are provided in **Table 7.14**

Table 7.13: Input Data for MEX for CALRoad View Version 6.5 (CALINE 4)

Sr. No.	Variables	Values
1.	St. Dev	20.55
2.	SPM	287.972 ug /m^3
3.	CO	1.611 ug / m^3
4.	NO	15.058 ug / m^3
5.	NO_2	43.914 ug / m^3
6.	O_3	21.994 ug / m^3
7.	Settling and Deposition Velocity	0.1 for PM, 0 for CO and NOx
8.	ROW	100 m
9.	Road Width	54 m
10.	Wind Speed	19.9 kmph
11.	Temp	21°C
12.	Road Surface	At Gradient
13.	Traffic Data (AADT) – 1st year of Operation	18,720 (Veh/ Day)
14.	Cars, Jeeps, SUVs, Vans	7,915 (Veh/ Day)
15.	Buses and Minibuses	1,085 (Veh/ Day)
16.	Truck and Trailer	9,720 (Veh/ Day)
17.	Traffic Data (AADT) – 20th year of Operation	69,521 (Veh/ Day)
18.	Cars, Jeeps, SUVs, Vans	38,494 (Veh/ Day)
19.	Buses and Minibuses	3,114 (Veh/ Day)

Sr. No.	Variables	Values
20.	Truck and Trailer	27,913 (Veh/ Day)
21.	Emission Factor Data	CO = 47.5 gm/Mile NO_2 = 8.2 gm/Mile PM = 0.9 gm/Mile
22.	Cars, Jeeps, SUVs, Vans	CO = 33.66 gm/km NO_2 = 1.05 gm/km PM = 0.33 gm/km
23.	Buses and Minibuses	CO = 47.18 gm/km NO_2 = 1.88 gm/km PM = 0.5 gm/km
24.	Truck and Trailer	CO = 7.66 gm/km NO_2 = 12.37 gm/km PM = 0.75 gm/km

Note: Emission Factors are taken from ADB approved EIA of Karachi BRT Redline Project (No. 47079-002), July 2019, [38]

590. Results and analysis of the estimated concentrations provided by the CALINE-4 for CO, NO_2, and PM for 1st year of operation of proposed traffic projection are given below:

Carbon Monoxide (CO)

591. The modeling exercise was carried out and CO dispersion isopleths map have been developed which are shown in **Figure 7.6**. Based on the modeling results, the maximum concentration of CO is 1.7 ppm (2.12 mg/m^3) for worst case one hours averaging period. The average recorded ambient baseline value of CO concertation measured at site is 1.41 ppm (1.76 mg/m^3) for 08 hours averaging period. The concentration of the CO after adding the MEX traffic is below the threshold value of the SEQS, 2016 limits for CO in ambient air quality which is 5 mg/m^3.

Nitrogen Dioxide (NO_2)

592. The modeling exercise was carried out for NO_2 dispersion by using CALRoads**.** However, the NO_2 concentration dispersion with proposed traffic data as provided **Table 7.14** is much less and the software output were not generated. The average recorded ambient baseline value of NO_2 concertation measured at site is 0.023 ppm (43.27 µg/m^3) for 24 hours averaging period. The concentration of the NO_2 after adding the MEX traffic may exceed the baseline values of NO_2 however, will be within SEQS, 2016 limits for NO_2 in ambient air quality which is 80 µg/m^3.

Particulate Matter (PM)

593. The modeling exercise was carried out and PM dispersion isopleth map has been developed which is shown in **Figure 7.7**. Based on the modeling results, the maximum concentration of PM is 296.90 µg/m^3 for worst case one hours averaging period. The average recorded ambient baseline value of PM concertation measured at site is 287.97

[38] Faiz, A., Weaver, C. S., & Walsh, M. P. (1996). Air pollution from motor vehicles: standards and technologies for controlling emissions. World Bank Publications.

µg/m^3 for 24 hours averaging period. The concentration of the PM after adding the MEX traffic is within the SEQS, 2016 limits for SPM in ambient air quality which is 500 µg/m^3.

594. Results and analysis of the estimated concentrations provided by the CALINE-4 for CO, NO_2, and PM for 20th year of operation of proposed traffic projection are given below:

Carbon Monoxide (CO)

595. The modeling exercise was carried out and CO dispersion isopleths map has been developed which is shown in **Figure 7.8**. Based on the modeling results, the maximum concentration of CO is 3.5 ppm (4.38 mg/m^3) for worst case one hours averaging period at 20th year of operation. The average recorded ambient baseline value of CO concertation measured at site is 1.41 ppm (1.76 mg/m^3) for 08 hours averaging period. The concentration of the CO after adding the MEX traffic is almost reaching threshold value of the SEQS, 2016 limits for CO in ambient air quality which is 5 mg/m^3.

Nitrogen Dioxide (NO_2)

596. The modeling exercise was carried out and NO_2 dispersion isopleths map has been developed which is shown in **Figure 7.9**. Based on the modeling results, the maximum concentration of NO_2 is 0.05 ppm (94.06 µg/m^3) for worst case one hours averaging period at 20th year of operation. The average recorded ambient baseline value of NO_2 concertation measured at site is 0.023 ppm (43.27 µg/m^3) for 24 hours averaging period. The concentration of the NO_2 after adding the MEX traffic is exceeding SEQS, 2016 limits for NO_2 in ambient air quality which is 80 µg/m^3.

Particulate Matter (PM)

597. The modeling exercise was carried out and PM dispersion isopleth map has been developed which is shown in **Figure 7.10**. Based on the modeling results, the maximum concentration of PM is 316.7 µg/m^3 for worst case one hours averaging period. The average recorded ambient baseline value of PM concertation measured at site is 287.97 µg/m^3 for 24 hours averaging period. The concentration of the PM after adding the MEX traffic is within the SEQS, 2016 limits for SPM in ambient air quality which is 500 µg/m^3.

598. The impact is permanent and medium significant.

Mitigation Measures

599. Following mitigating measures are needed to be suggested:

- Helping the owners and occupants of the affected premises to identify and implement special measure such as hedges and vegetation to reduce air pollution.
- Greenbelt Development Increasing vegetation in the form of greenbelt is one of the preferred methods to mitigate air pollution. Plants generate oxygen, serve as a sink for pollutants, reduce the flow of dust too alongside the road.
- A tree plantation plan (as suggested in this EIA report) is strongly recommended to reduce the pollutant propagation to the receptors as an additional advantage of road aesthetics. One (01) row on either side of the road is proposed for this expressway.

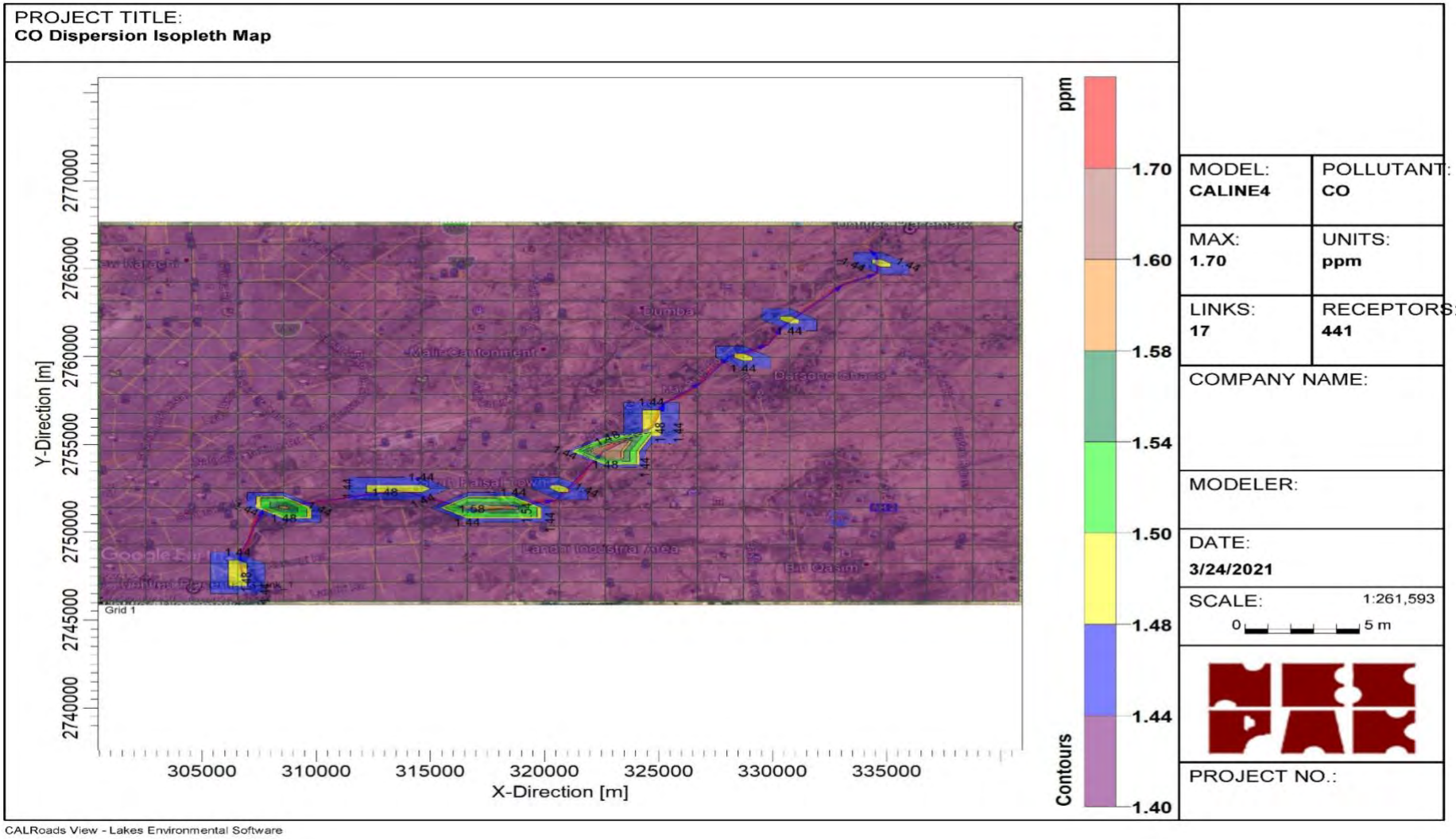

Figure 7.5: CO Dispersion Isopleth Map of MEX (For 1st Year of Operation)

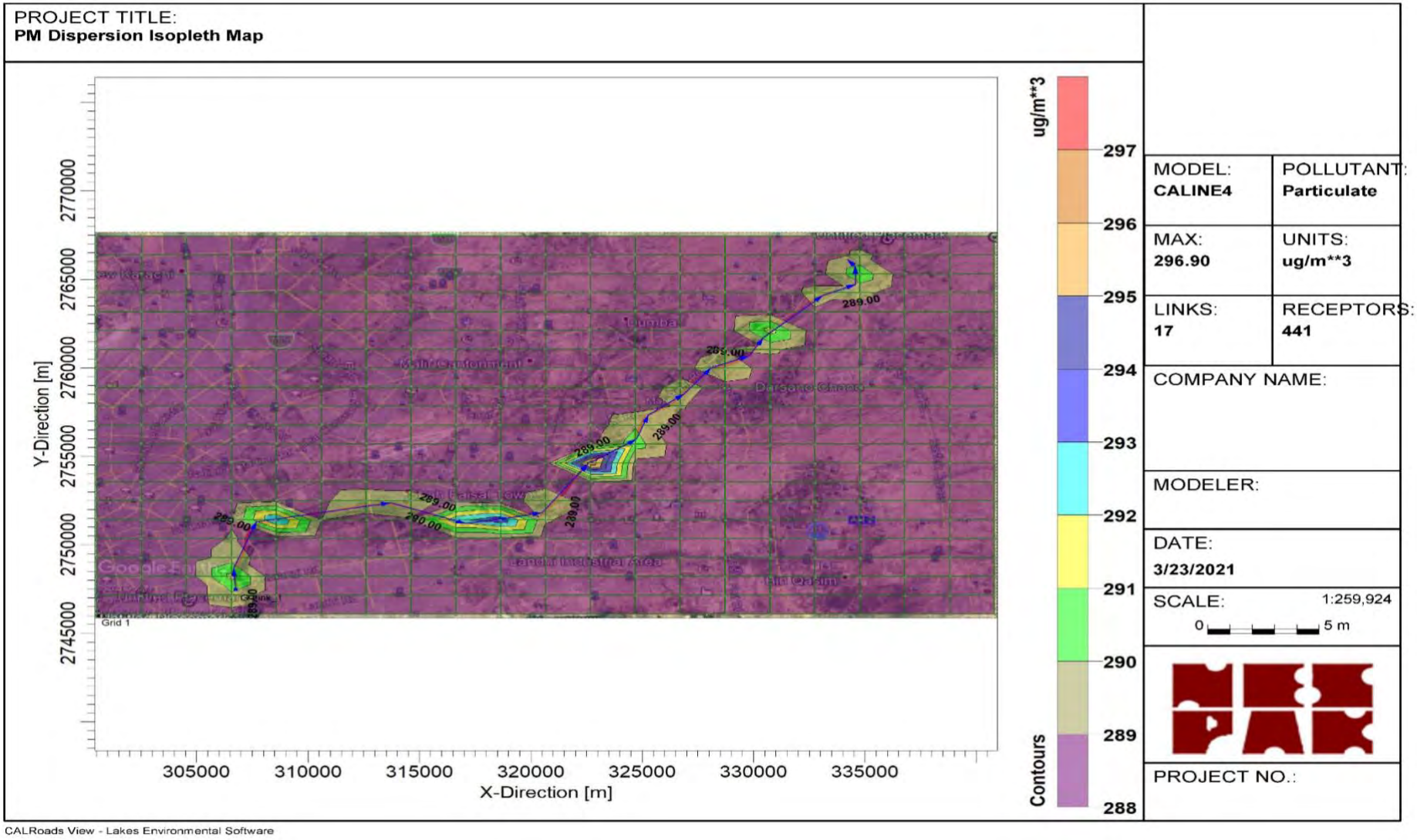

Figure 7.6: PM Dispersion Isopleth Map of MEX (For 1st Year of Operation)

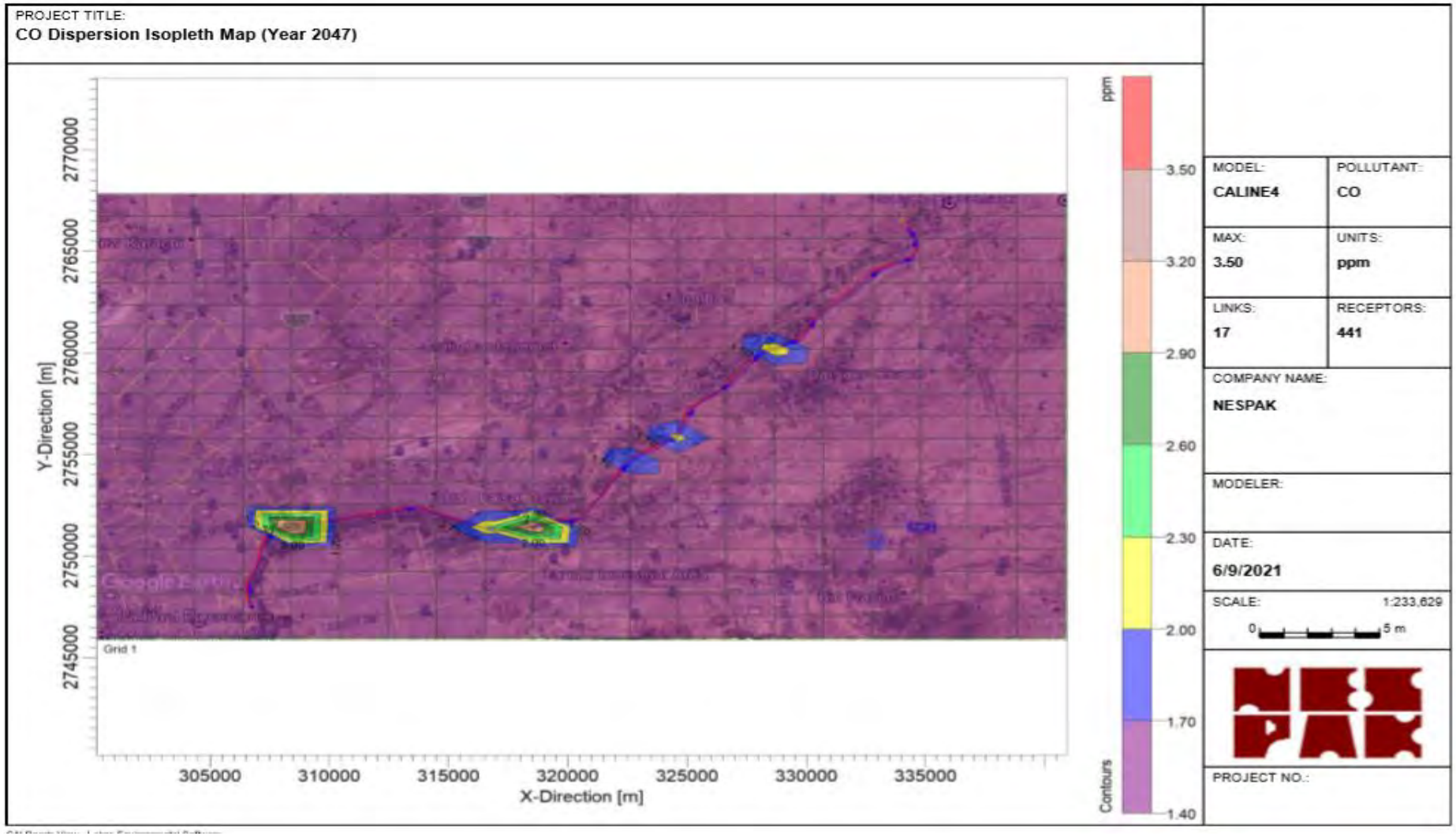

Figure 7.7: CO Dispersion Isopleth Map of MEX (For 20th Year of Operation)

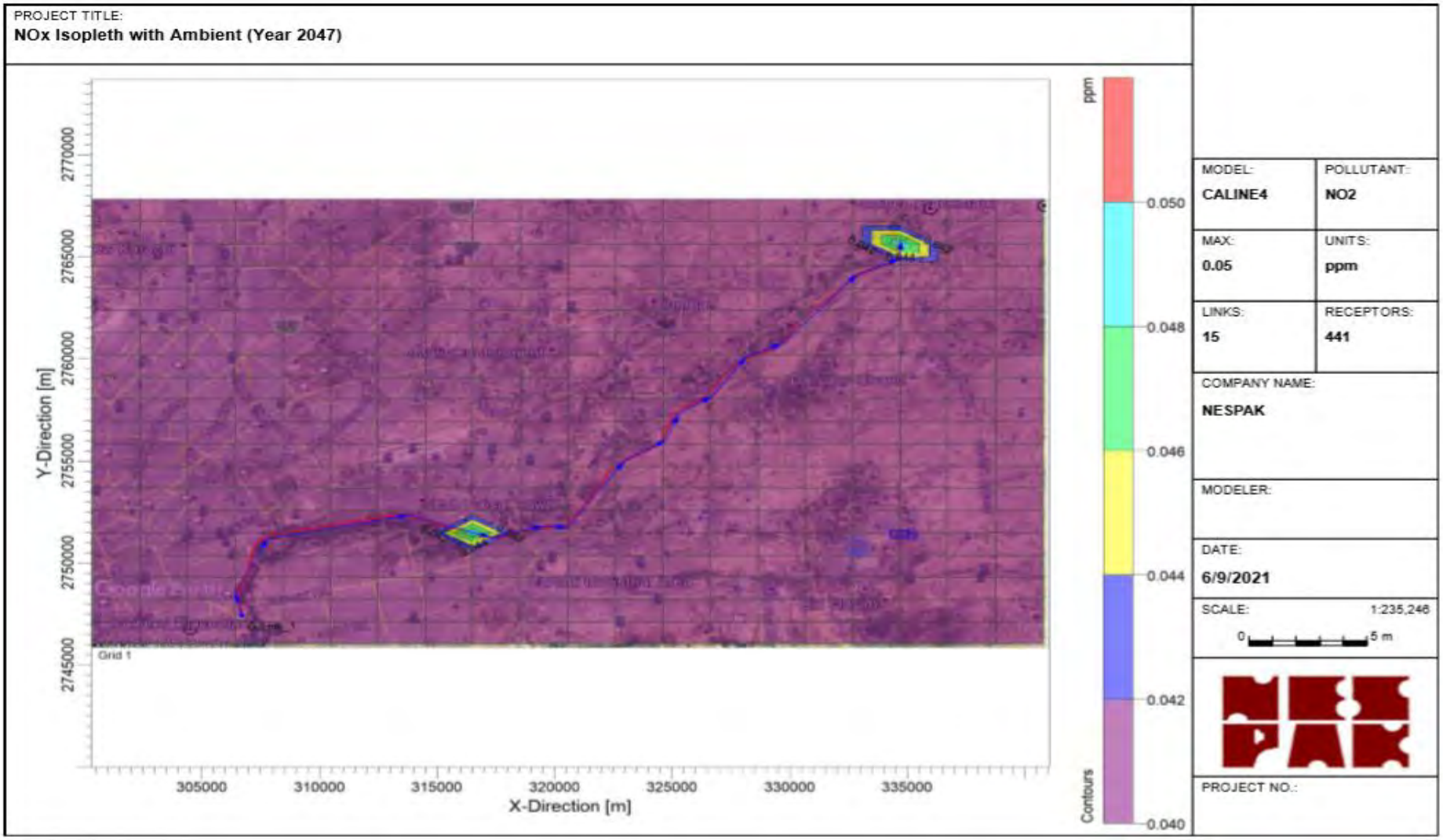

Figure 7.8: NOx Dispersion Isopleth Map of MEX (For 20th Year of Operation)

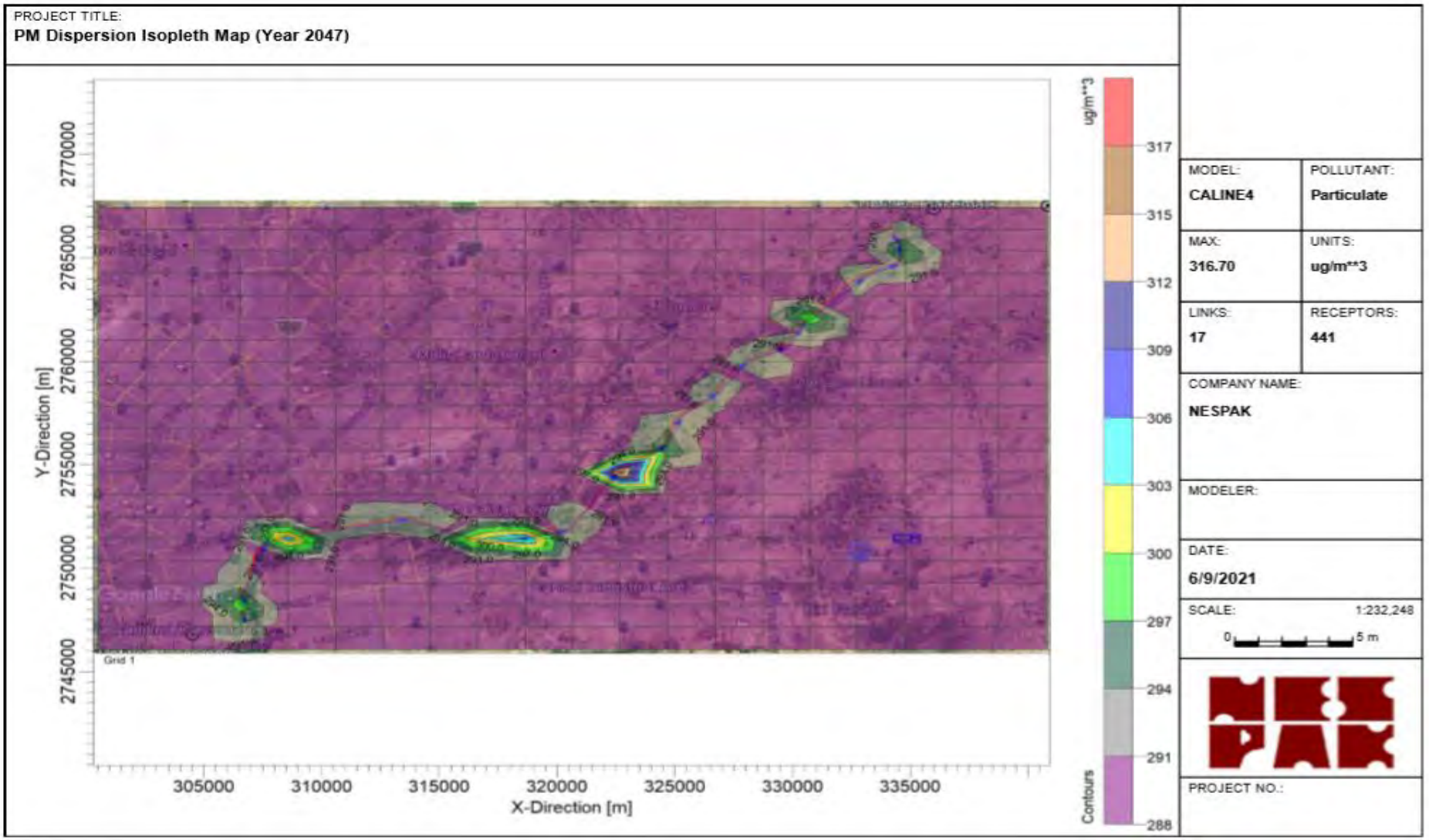

Figure 7.9: PM Dispersion Isopleth Map of MEX (For 20th Year of Operation)

7.5.3.2 Change in GHG Emissions

600. As this traffic is diverted from the other routes of Karachi, thus the emissions of GHG are likely to be slightly less than that from the existing route(s) since traffic volumes are not expected to vary substantively from the current route(s) and the idling of engines may also reduce. Therefore, the emissions are not considered to be substantive and are not likely to result in overall Change in GHG Emissions of whole city / project area / surroundings.

Mitigation Measures

601. The mitigation measures of air quality and traffic management will help to mitigate the impact of GHG emissions.
602. Plantation of trees and vegetation to counteract the effects of GHG emissions

Tree Plantation

603. A tree plantation plan (as suggested in this EIA report) is strongly recommended to reduce the noise propagation to the receptors as an additional advantage of road aesthetics. One (01) row on either side of the road is proposed for this expressway[39].

7.5.3.3 Road Safety

Potential Impact

604. Enhanced vehicular movement and speed in the long run may result in road safety issues like traffic accidents. This impact is permanent but moderately adverse in nature, since the frequency of accidents may be lowered, but their intensity may be quite severe due to enhanced speeds at which vehicles will move. The impact may be considered permanent and high adverse in nature.

Mitigation Measures

605. Strict enforcement of speed limits, installation of speed guns and channelization of traffic with respect to categories (heavy vehicle traffic and light vehicle traffic), should be ensured for the smooth flow of traffic moving from major road crossings. Enforcement of penalties for the violators will reduce the significance of this impact.

7.5.3.4 Drainage

Potential Impact

606. During the operational phase, poor maintenance of the road drainage system, particularly during the monsoon season can cause nuisance to the travelers and public due to flooding in the existing drainage line. In case of choking of road drainage, the increased surface runoff due to heavy rains will accumulate at the start and end point of the proposed MEX Project and can cause traffic jams. The impact can be moderate adverse in nature.

Mitigation Measures

- The impact can be controlled/reduced by timely and continuous maintenance/ cleaning of the drainage system; and
- Placement of sign boards instructing not to dispose of solid waste to avoid choking of drain around the bridge and at grade road alignment.

[39] *Dobson, M., & Ryan, J. (2000). Trees and shrubs for noise control. Arboricultural Advisory and Information Service.*

7.5.3.5 Road Maintenance Works and Heavy Traffic

Potential Impact

607. During the operational phase, different maintenance works will be carried out throughout the Project life. Laborers or staff involved in these maintenance works are exposed to health and safety issues. Poor implementation of HSE plans or noncompliance of personal protective equipment's (PPEs) can lead to personal injuries and accidents. Moreover, application of poorly maintained equipment's and material can lead to air pollution. The maintenance works can also cause traffic problems to the travelers. Lack of maintenance may also lead to ground water and soil pollution. The impact of noise will only be due to construction of the proposed Project as the settlement are nearby the road. This impact is temporary and minor adverse in nature.

Mitigation Measures

608. Important points to be addressed in the operational stage are as follows:

- Implementation of HSE Plans during the maintenance period;
- Strict implementation of personal protective equipment's PPEs;
- Use of high quality equipment and material by the contractor;
- Continuous improvements in the emergency plans;
- Placement of sign boards for traffic diversions and proper implementation of traffic diversion plans;
- Selection of suitable sites for contractor camps and implementation of all the related important protocols for the management of camp activities in order to avoid environmental and HSE issues;
- Understanding and training of staff on Operation and Maintenance Manual;
- Regular maintenance of engineering works;
- Maintain vegetated areas in adequate cover to meet the intended purpose(s);
- Conservation practices that limit particulate matter emissions should be incorporated into long-term maintenance plans;
- Blowing of pressure Horns by the vehicle will be strictly prohibited; and
- Continued public consultation and feedback on it.

7.5.3.6 Fauna

Potential Impact

609. There is no protected area, game reserve, wildlife sanctuary or National Park in the Project Area so, no major impact on wildlife and livestock in the area is expected. However, during the operation phase of the Project, increased noise due to increased traffic will disturb the wildlife, especially the birds, which will avoid this area. This impact is site-specific, permanent, irreversible, possible, and medium significant. Furthermore, new plantations will not only compensate for the loss of trees but will also add to the aesthetics of the area. So resulting in healthy and positive impacts on flora and fauna during the operation stage.

Mitigation Measures

- Cattle creeps have been provided throughout the length of the expressway to allow for cattle and other livestock to cross below the expressway and maintain their habitual practices.
- In proper consultations with Forest and Wildlife Department, permanent water points for available fauna may be provided to conserve local ecosystems and biodiversity.

7.5.3.7 Flora

Potential Impact

610. During operational stage of the Project, there will be no effect on flora (trees and agricultural crops) or release of any significant pressure detrimental to flora. Low level impact is expected at operational phase on flora due to the operational and maintenance (O&M) activities. This impact is site-specific, temporary, short-term, irreversible, and of low significance.

Mitigation Measures

- Little to no negative impacts are envisaged on the flora of the tract during the operational phase. Moreover, massive plantation shall be raised on both sides of this 39-kilometre-long expressway, which will not only compensate for the loss of trees from the Project Area but will also improve the landscape of the area.
- The implementation of plantation plan recommended as compensation for cutting of trees should start working during operational stage, to ensure the intactness of the ecological balance and to avoid any impact on local Environment.
- Large scale planting with suitable indigenous fruit and forest trees, shrubs, and ornamental plants in the form of trees, and linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation.
- Proper check and balance for above activities is highly recommended. Plantations carried out must be maintained according to the silvicultural practices which include proper Irrigation, Cleaning, Pruning, thinning at prescribed intensity, Silt clearance and Trench-opening, etc.
- Maintenance and security of the plantation should be done for at-least five years (in consultation with the forest department). Measures such as fencing, watch guards and fire protection should be considered.
- All activities must be done under the technical supervision of concerned Forest Department.

7.5.3.8 Agriculture

611. Improved infrastructure facilities will help the farmers to fetch better prices for their produce, due to easy and swift approach to the markets in Karachi and other big cities of the country, which will have a positive impact.

7.5.3.9 Changes in Land-use

Potential Impacts

612. Road transport network development has significant impact on land use patterns. The most significant impact of construction of road on land development occurs when access is provided to land. Increased access to land raises its potential for development, and more development generates additional travel. Once access has been provided, land patterns begin to change over time.

Impact on Traffic Flow

613. The flow of traffic is expected to be ameliorated especially on the streets in the city, with the advent of this project.

7.5.3.10 Landscape

Potential Impact

614. During the operation stage, new saplings of different plants and trees would be planted to enhance the aesthetics and compensate the loss of affected trees. This will have a positive impact of permanent nature. The presence of adequate flora at available spaces along the proposed alignment will help in absorbing flue gases, emitting from many vehicles and public transport passing through the Project Area, which shall help improve the air quality.

Mitigation Measures

615. The saplings planted in the Project Area against the trees affected should be properly maintained throughout their growth period.

7.5.3.11 Change in Aesthetic Value

616. Construction of the proposed road, interchanges, bridges, and culverts will change the aesthetic value of the area. Proper landscaping and plantation of grasses and ornamental plants along the alignment will increase the aesthetic value of the proposed Project Area and will have a positive impact.

7.5.3.12 Employment

617. During the operation phase of the proposed Project, economic activity will be generated in the Project Area as the semi-skilled and technical staff will have an opportunity to work for the operation and maintenance of the proposed Project. This is a permanent and moderate beneficial impact.

618. Moreover, improved infrastructure will promote new business opportunities. In addition, such an activity will also increase the land value that will benefit the residents. This impact will be permanent and major positive in nature.

7.6 RESIDUAL IMPACTS

619. Residual impacts refer to those environmental effects predicted to remain after the application of mitigation outlined in this EIA. Through careful design and planning, combined with prudent application of proven mitigation measures, all potential adverse environmental effects have been identified and addressed, and reduced the predicted adverse impacts to a low level of significance. The MEX Project will also have important economic benefits both locally and regionally.

7.7 CUMULATIVE AND INDUCED IMPACT ASSESSMENT

7.7.1 General

620. As per definition, the cumulative impacts are "*the impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable* future *actions regardless of what agency (federal or nonfederal) or person undertakes such other actions*"[40].

621. The purpose of this section is to assess the impacts of proposed Project cumulatively with those of other proposed *projects* within or close to Project's CoI limits.

7.7.2 Identification of Current and Proposed Projects

622. CIA is a challenging task as its analysis builds upon information derived from direct and indirect impacts due to past, present, and future interventions in a defined geographical area including the current and proposed projects. Therefore, cumulative impacts on the proposed Project are, in concept, related to recently completed, under-construction and proposed *developments* within and nearby the CoI of proposed Project. As a first step, an effort was made to identify the projects within or nearby the CoI through various sources such as collecting information through locals, visual observations and literature review. The cumulative impacts have been assessed through expert judgment, GIS (overlays methods) and information obtained from locals. Major developmental Project near to the CoI of the proposed Project Area are:

- M9-N5 Link Road Project;
- Karachi Bulk Water Supply System Project; and
- Urban Road Initiative Project.

623. The brief of these projects is as follow:

7.7.2.1 M9 to N5 Link Road Project

624. The proposed Link Road Project (LRP) envisages a four-lane dual carriageway with an unpaved median of 3.5 m. The approximate length of the Project is 21.4 km. Geometric design of the Project has been developed for a speed of 100 kph. The Proposed Project is in District Malir of Karachi City of Sindh province which can be easily accessible via M9, N5 or Link Road Bypass. The Proposed Project also includes one (01) toll plaza, one (01) interchange, fourteen (14) U-turns, one (01) bridge, twenty-nine (29) culverts and one (01) roundabout intersection near M9. The Project is scheduled to be completed in twelve (12) months.

[40] Environmental Assessment Guidelines by Asian Development Bank (2003)

7.7.2.2 Karachi Bulk Water Supply System Project

625. Presently, Karachi is drawing 520-530 million gallons per day (MGD) water from Keenjhar lake against approved quota of 650 MGD water. KWSB planned to construct 65 MGD conveyance system from Keenjhar Lake. In brief, this Project aims at developing a bulk water conveyance system for the balance water available, including existing scheme of 65 MGD water, so as to minimize the domestic water shortages in Karachi city.
626. The proposed bulk water supply enhancement scheme shall consist of construction of integrated system comprising of conduit, inverted siphons, pumping stations, rising main(s) & interconnection at different drawl points of the existing bulk water supply system of KWSB and the conveyance of the additional water to the deficit pockets of various areas of Karachi. Major components of the KWSB conveyance system are given in **Table 7.19**.

Table 7.14: Components of Karachi Bulk Water Supply System

Sr. No.	Name of Canal	Design Capacity	Type	Length (Km)
1	Keenjhar-Gujjo (KG) Canal	650 MGD	RC Lined	29.30
2	Greater Karachi (GK) Canal	280 MGD	RC Lined	17.30
3	K-II Canal	200 MGD	RC Lined	17.25
4	Siphon & Conduit of GK & K-II Canal	480 MGD	RC Conduit	10.25
5	Rising Main	520 MGD	MS Pipe	4.80
6	GK Conduit	280 MGD	RC Conduit	61.89
7	K-II Conduit	100 MGD	RC Conduit	61.89
8	K-III Conduit	100 MGD	RC Conduit	61.89
9	K-IV	650 MGD	RC Conduit	120

7.7.2.3 Urban Road Initiatives

A: Link Road for Korangi

627. The proposed road starts from a distance of 01 km from KPT Interchange, a bridge is proposed which will connect Creek Avenue & Malir Expressway to Korangi Creek Road. The link road extends from the bridge and ends at Airmen Golf Course. Another segment of road extends from Korangi link road passing adjacent to Korangi Creek Industrial park and joins Korangi Creek Road. The expected duration for construction is approximately 6 months. The salient features of the Project are as follows:
    - Start point – Creek Ave / Korangi Causeway Intersection
    - End point – PAF Airmen Golf Club
    - Total Length – Approx. 12 km (with elevated portions)
    - Alignment – Parallel to Jam Sadiq Bridge along Left Bank of Malir River.

B: Expressway from Mauripur Road to Y-Junction

628. The Project Area is located in Karachi. The proposed Project involves construction of an Expressway with a length of approximately 7.9 km (with Ramps and Flyover/Bridge) starts from Mauripur Road near Lyari Expressway and ends at Y-Junction of Kakapir Road and Mauripur Road. Approximately 9.4 acres of land will be acquired for the Project. The expected duration for construction is about six (6) months. The tentative manpower required during the construction is 30-50 people and estimated Project infrastructure cost is Rs 8 billion.

C: Interchange at ICI Bridge

629. ICI intersection is one of the busiest intersections which carry a large number of heavy vehicles from the East and West Wharves of Karachi Port. Cross street traffic from Kharadar constitutes private vehicles (motorcycles, rickshaws, small cars), which mostly serve the needs of residential area of Kharadar. Start point Project is 0.3 Km North of ICI Bridge Intersection at Mauripur Road and End point is proposed elevated right turn merges at ICI Bridge at Railway Crossing / Ghulam Ali Allana Road. Total length of the proposed Project is 1.75 km in which 0.56 km is elevated. Construction work of the proposed Project is scheduled to be completed within twelve calendar months from the Date of Commencement of Construction work at site. In order to maintain three (3) lanes in each direction, approximately 681 sq. meter area is required for the proposed improvements.

630. The relative distances of these projects (interventions) from the proposed MEX is provided in **Table 7.17** and location shown in **Figure 7.13.**

Table 7.15: Relative Distance of Major Developmental Projects from MEX

Sr. No.	Project Name	Project Status	Distance from MEX (km)
1	MEX to M9-N5 Link Road Project	Proposed	5.11
2	MEX to Karachi Bulk Water Supply Project	Proposed	2.8
3	MEX to URI		
3 (a)	MEX to Korangi Link Road Project	Proposed	0.35
3 (b)	MEX to Interchange at ICI Bridge Project	Proposed	9.92
3 (c)	MEX to (Y-Junction to ICI Bridge) Project	Proposed	11.25

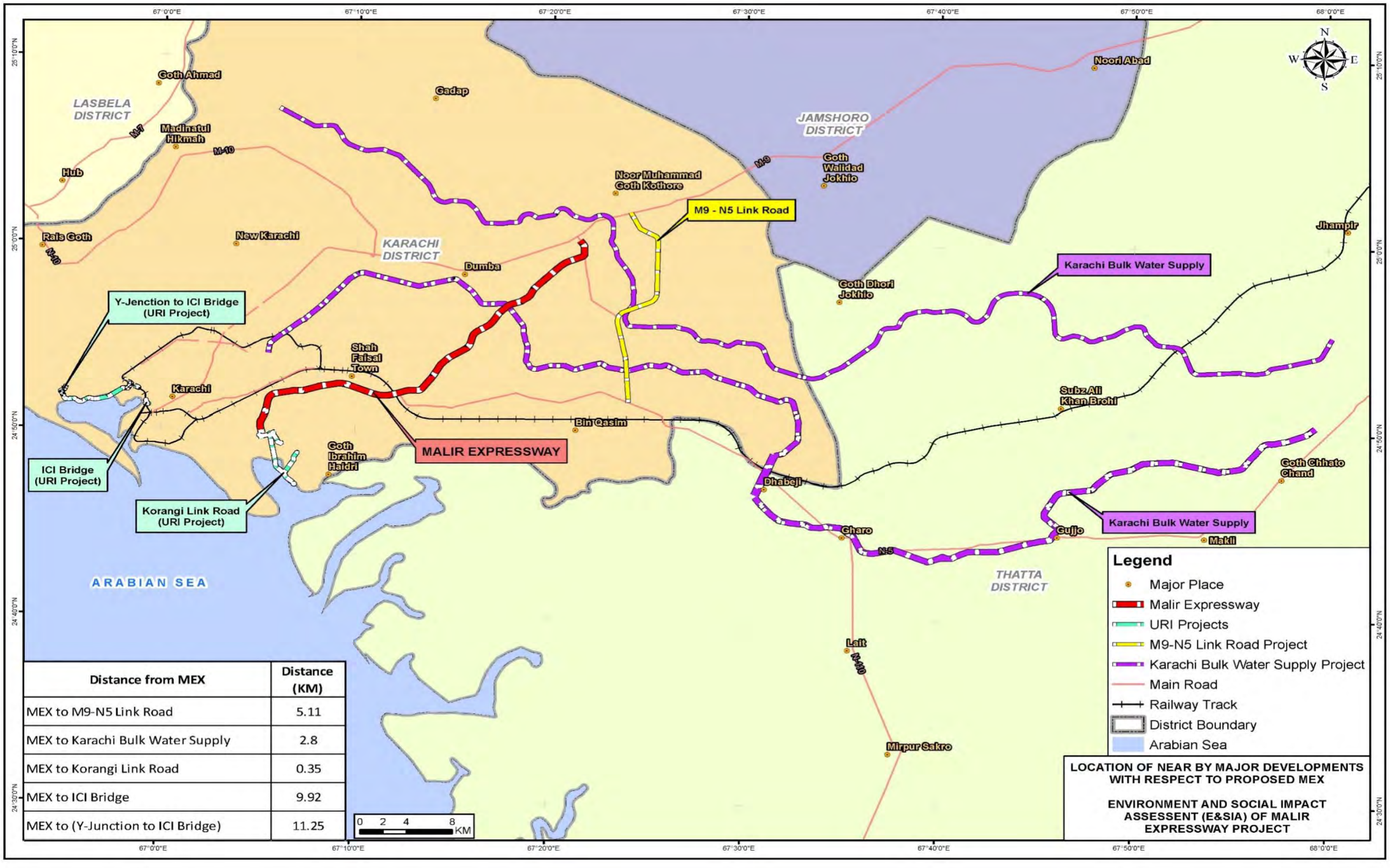

Figure 7.10: Major Developmental Project near Proposed MEX

7.7.3 Methodology

7.7.3.1 Corridor of Influence (CoI) and Area of Influence (AoI)

631. CoI of proposed Project is already defined in **Chapter 1** of this report, however, activities in nearby vicinity of CoI have also been considered for Cumulative Impact Assessment (CIA). CIA has been done based on findings prescribed in other parts of EIA. The terms AoI and CoI are interchangeably used in this report.

7.7.4 Valued Environmental Components

632. Based on the desktop study of Project's CoI, its resources and screening analysis, no sensitive receptor will be directly affected by Project interventions. However, some Valued Environmental Components (VECs) were identified by keeping in view the Project construction and operational phase activities in context of above-mentioned developments. VECs with respect to physical, biological, and social perspectives are identified and listed below:

- Physical Environment
  - Landscape and Aesthetics;
  - Ambient Air Quality; and
  - Water Quality.
- Biological Environment
  - Flora; and
  - Fauna.
- Social Environment
  - Social & Cultural Conflicts;
  - Agriculture & Livelihood;
  - Transportation; and
  - Economy.

7.7.5 Potential Cumulative Impacts

7.7.5.1 Physical Environment

633. **Landscape and Aesthetics:** Deterioration of aesthetics and visual amenity of nearby receptors due to construction activities, including vehicular movement on roads, may cause disturbance in aesthetics for tourists, businesses, and nearby communities. Construction and operational *phases* of above-mentioned projects will result in enhancement of commercial activities in the area. Increase in commercial activities will automatically increase land prices which is a positive impact. Therefore; the impact can be categorized as positive impact.

634. **Ambient Air Quality:** The construction of M9-N5 Link Road Project, Karachi Bulk Water Supply Project and Urban Road Initiative Project will cause dust and gaseous emissions

during the construction stage due to various construction activities and vehicular movement. This impact is cumulatively increased due to these Project interventions.

635. **Water Quality:** Proposed Project has impact on surface water quality of the water bodies of the area especially Malir River during construction phase if excessive or uncontrolled spill or leakage of chemicals / fuel take place. This scenario may add on surface water pollution in Mali river and other canals in combination with construction activities of M9-N5 Link Road Project respectively.

7.7.5.2 Biological Environment

636. The overall developmental projects of roads in the cascade will not have potentially significant impacts *on* the natural environment and other areas of interest related to the nature. Impacts of the proposed bypass construction Project foreseen moderate in nature.

637. **Flora:** The above mentioned/ discussed projects will have different level of impacts on vegetation, due to construction of interchanges, road section other structures, which will cause direct negative impacts on flora and cutting of tress. Construction activities result in cutting of trees and clearing of ground vegetation having significant adverse impacts to environment. The tree cuttings along the proposed RoW will show negative effect on the local and regional environment. Construction of access roads, and workers' camps causing clearing of land, resulting in loss of vegetation of these lands. Cutting of trees at such a huge level will result in destruction of natural habitats for which the required tree plantation plan provided in EMP needs to be implemented at the time of Project implementation which will compensate the above losses.

638. **Fauna:** The roads may become dangerous for the movement terrestrial/local animals. During the operation phase, increase traffic volume will generate a lot of noise which will disturb the current faunal species such as birds, rodents and reptiles which is an adverse impact on fauna. The adverse impacts due to cutting of trees (as dissected above) are also expected on wildlife as well, as these trees are providing food and shelter to different faunal species. To overcome/mitigate the habitat losses, mitigation measures provided in the EIA report must be adopted to reduce the negative impacts of proposed Project.

7.7.5.3 Social Environment

(a) Human Disturbance

639. The proposed developments have the potential adverse impact on the residential area, commercial activities, and agricultural areas. Due to the implementation of the Project a vast physical displacement will occur in the result of human displacement, economic activates will also be affected and the DPs will face unemployment. All social issues will be addressed in the Land Acquisition and Resettlement Plan LARP that will be developed.

(b) Social and Cultural Conflicts

640. Development of the proposed road may have a significant impact on the community's ability to accommodate new residents and adapt changes in the social environment for existing residents. Therefore, social conflicts may arise and disturb the harmony of the Project Area. The significance of impact will be high during construction and moderate during operation of proposed developments in the area.

641. The proposed Project will draw small business and commercial activities, new workforce, and their families into the community, either as permanent or temporary residents. When this occurs, the incoming population will affect the social environment in various ways, including increased demand for housing and social services (e.g., health care, education, recreational facilities, etc.). It will cause the inadequacy of health care and social services, incompatibility of interests, resettlement/displacement, corruption, domestic violence, change in customs and norms and disruption and delays of social and cultural events.

(c) Economy

642. Due to the construction of proposed Malir Expressway Project, economic activity will be generated in the Project Area as the laborers and semi-skilled staff will have an opportunity to work for the construction of the proposed Project. This will help in developing their skills, capacities and generate income sources for them. Growing communities in the Project Area will also attract a variety of new commercial developments, including both freestanding stores and community shopping centers. These developments will provide community with products, services, and conveniences important to the quality of life of residents. It will have the positive impact on the livelihood of the residents and enhance their living standards.

(d) Traffic Issues of the City

643. The rapid increase in population has put a lot of pressure on the city's infrastructure, especially the urban transport system (UTS) which is not yet organized in a modern manner, and therefore hardly caters to the mobility needs of the mega city. The city is facing severe traffic congestion and unnecessary delays, noise, and air pollution along the main corridors of travel in the city and impeding the economic efficiency and growth. Therefore, the construction of Malir Expressway is a dire need of the city to resolve the traffic issues in the area.

7.7.6 Conclusion

644. Keeping in view the above impact assessment, it can be concluded that there will be no adverse significant impacts on physical, ecological, and socioeconomic environment due to proposed Project in accordance with the nearby developments. It is recommended that the implementation of the tree plantation plan and mitigation

measures for other physical, ecological, and socio-economic domains mentioned in EMP along with regular monitoring and audit as provided in the EIA report will further reduce the significance of the impacts.

7.8 POSITIVE IMPACTS

645. Following major positive impacts are foreseen with the establishment of the proposed Project:

- Upon its completion, the travelling time from the Karachi-Hyderabad Motorway, M-9 to KPT Interchange on the main Korangi Road (Formerly known as the Hino Chowk) will be reduced to only 30 minutes. Therefore, the daily commute between Karachi Port, Industrial Areas of Landhi and Korangi, and also between the CBD Area, Clifton and DHA (Phase 1 to 8) and the proposed DHA City & the Education City would be more convenient, uninterrupted and economical;
- The traffic conditions on the urban road network in Karachi would also improve substantially as the external traffic would shift to Malir Expressway;
- In addition to light traffic, this expressway will also serve the heavy traffic generated from the Karachi Port and the Landhi - Korangi Industrial Area and going towards Motorway (M9) for onwards journey upcountry;
- The proposed Project will help reduce traffic congestions, delays, economic losses and environmental pollution on the city road network by exclusion of the external traffic i.e., traffic having both its origins and destinations outside the city or on its periphery, from the present routes to the proposed Malir Expressway;
- Improved communication infrastructure will promote new business opportunities. In addition, such an activity will also increase the land value that will benefit the local residents of industrial areas of Landhi and Korangi, and also between the CBD Area, Clifton and DHA (Phase 1 to 8) and the proposed DHA City & the Education City;
- Due to the construction of the proposed Project, economic activity will be generated in the Project Area as the labour and semi-skilled staff will have an opportunity to work in the Project Area. This will provide them an opportunity to develop their skills and capacities;
- Raising of new trees on either side of the road shall render a positive impact on the flora of the area and will also cause a positive impact on the landscape of the area, which shall be of permanent in nature; and
- After the construction of proposed road, the landscape of the Project Area will be changed in terms of road infrastructure, construction of bridges & flyovers, interchanges, and planned plantation of trees along the road. This will have a positive impact in terms of socio-economic development of the Project Area.

8 GRIEVANCE REDRESS MECHANISM

8.1 GRIEVANCE REDRESS MECHANISM (GRM)

646. A Grievances Redress Mechanism (GRM) provides a way to reduce risk for the proposed Project, by offering communities an effective system for expressing concerns achieving remedies, and promotes a mutually constructive relationship. Moreover, it provides the structure, roles and functions of the GRM, to address the grievances arising due to execution of the Project works. It provides a predictable, transparent, and credible process to all parties, resulting in outcomes that are seen as fair, effective, and lasting.

647. The Grievance Redress Mechanism GRM is proposed to address any complaints or grievances arising during the implementation period of the projects undertaken by Project Authority such as (Local Government Department) which is responsible for executing the Project. Members of the public may perceive risks to themselves, or their property, or their legal rights or have concerns about the possible adverse environmental and social impact that a Project may have. Any concerns or grievances should be addressed quickly and transparently, and without retribution to the affected person or complainant.

648. The primary principle is that any complaints or grievances are resolved as quickly as possible in a fair and transparent manner. However, the Project based GRM will not bar aggrieved persons to avail remedies available under the court of law and they will be at liberty to approach the court of law as and when they wish to do so.

649. To address the land acquisition and resettlement issue a mechanism will be established to address/resolve the Project related grievances including the DPs concerns or grievances related to impact assessment, valuation and compensation to eligible DPs resettlement and relocation related grievances as well as social and environmental grievances encountered during execution of the Project works. Accordingly, the GRM proposed in the LARP being prepared is tasked to address any grievances raised by DPs on LAR implementation grievances and their concerns related to social and environmental grievances that could arise during execution of Project work.

650. At first instance, the efforts will be made to avoid grievances through strong consultations participation and information disclosure strategy and the LAR activities will be conducted in accordance with the LARP provisions. Nevertheless, it may be expected that some problems cannot be resolved through Consultation, Participation, and Information Disclosure Strategy (CPID) actions and, therefore, DPs require an accessible and effective GRM. The Project (Malir Expressway) will put in place its GRM structures from the beginning, i.e., as soon as activities for Project design and preparation or implementation of LARP and from the commencement of the construction activities. The GRM will remain intact throughout Project implementation period to address the community concerns and grievances arising during execution of Project works.

651. The formal GRM will be set up with a three-tiered structure including: first at site/village level set-up through community involvement; second at Project Implementation Unit (PIU) level and third at Project Management Unit (PMU) level enabling immediate local recourse to address grievances and higher-level review for addressing more difficult cases not resolved at the PIU or local level. To ensure that all geographic reaches and relevant administrative units involved in the Project are covered, the GRM will set up (i) a local mechanism in each affected site with grievance redress focal points and; (ii) a grievance redress committees (GRC) at PIU and PMU levels.

652. A three tier GRM system will deal with all cases of grievances arising out of Project implementation, particularly focusing on social/resettlement and environmental management and implementation of the Project. The functions and responsibilities for each level of GRM are explained below.

653. Grievance Redress Mechanism (GRM) is important for developmental projects where ongoing risks or adverse impacts are anticipated. This mechanism serves to meet Project requirements, prevent, and address community concerns, reduce risks, and assist larger processes that create positive social change. The major objective of GRM is to implement and maintain a procedure for handling environmental and social concerns or grievances /complaints of the Project stakeholders. This GRM procedure will include a redress mechanism scaled to the Project's identified risks and adverse impacts, focusing on stakeholders.

8.2 FIRST LEVEL OF GRM

654. The first level of grievance redress system includes the Site/village level displaced person committee (DPC) selected and nominated by the displaced persons from each affected settlement located along the Project Road alignment. The DPC will be presided by its president who will be selected by the committee members nominated by the displaced persons. These DPCs will be a formal node for coordination and communication with the Project execution authorities and are required to act as local node for recording and redress of grievances as per their local customs and practices. The technical staff will maintain a close liaison with the DPCs to guide and assist them in recording and resolution of grievances. In this regard, the resettlement/environmental specialist and social mobilizers will closely coordinate and work together with the DPC members and the local community to ensure grievances are recorded, investigated, and discussed during DPC's meetings and guide them to explore and recommend remedial measures at their level. They will also liaise with the counterpart engineering staff, and contractors to ensure implementation of the DPC's recommendations and/or raising the complaint to second level of GRM/GRC for review and redress if the grievances are not resolved at DPC level.

8.3 SECOND LEVEL OF GRM

655. If the grievance is not resolved at site DPC level, it shall be raised to formal grievance redress mechanism which is second level of GRM. A formal complaint will be tendered

with the PIU GRC by the aggrieved DPs or through the social mobilizers. A complaint register will be maintained by the GRC through concerned Environment & Social Safeguard staff (land management issues, environmental degradation issues, social issues occur during implementation phase, etc.) to record the complaints received covering complaint receipt date, name and address of the complainant, gist of complaint, gist of field report, decision of GRC with its communication date to the DPs and decision implementation status or elevating the complaint to next level of GRM in case of disagreement by the aggrieved DPs.

656. Once the complaint is submitted with the PIU GRC, it shall be recorded in complaint register and send acknowledgement to the DP without delay; and initiate the process of investigation within 5 business days through its technical and resettlement field teams. After receipt of directions of GRC, the field teams including resettlement specialist and Land Staff will coordinate with complainant and complete its investigation of facts in consultation with aggrieved person, DPC representatives and local community and submit its fact-finding report and recommendations to the GRC within 15 business days from the receipt of complaint. Upon receipt of the fact-finding report, the GRC will summon and hear the aggrieved person and decide the complaint based on ground facts but in accordance with the agreed entitlements and provisions in the LARP/entitlement matrix and communicate its decision to the PMU and DPs within next 15 days. On an overall basis, the GRC will decide the grievances within 30 business days of receipt of complaint in GRC. If the final decision made by GRC is not acceptable to the DPs, they may advise GRC for elevation of their grievance to next higher level of GRM.

8.4 THIRD LEVEL OF GRM

657. In case the Displaced Persons (DPs) is unsatisfied with GRC decision, he himself or through GRC can elevate his complaint to third level of GRM i.e. at Environmental and Social Safeguards Unit (ESSU) in Project Management Unit (PMU) within 5 business days after GRC decision on complaint. Once the complaint is received at PMU along with GRC proceedings, it will be registered in PMU and the complainant will be informed by PMU staff accordingly. The GRC record and complainants' claim will be scrutinized and the complainant will be advised to produce any additional record in favor of his claim. After thorough review and scrutiny of the available record ESSU/PMU can visit the field to meet the complainant, collect additional information and evidence if required. Once the investigations are completed the PMU/ESSU shall get its recommendations approved by member committee and forward these to the Project Director of Malir Expressway and the complainant accordingly within 30 days of receipt of the complaint. If still the grievance remains unaddressed, the complainant may directly approach the Court of Law as and when desired.

8.5 CONSTITUTION AND FUNCTION OF THE GRC

658. The primary objective of the Project based GRC is to provide a mechanism for mediating grievances and cutting down on lengthy litigation. It will be a public forum for raising

concerns and invoking conflict resolution system available within the Project for addressing LAR related and other social or environmental grievances adequately. The GRCs will continue to function, for the benefit of the DPs, during and after implementation of LARP till completion of the Project.

659. The GRC will be headed by the Project Director, with members mentioned in the composition of the GRC. The member of the GRC could be increased, decreased, and replaced at the time of the notification of GRC, according to the requirement and nature of grievances.

660. For redress of grievances, the GRC will meet at least once in a month. For social safeguards, the GRC will review grievances involving all resettlement grievances including, compensation, relocation, and other assistance. GRC will perform following functions:

- Record grievances of DPs; categorize and acknowledge the DPs about receipt of grievances; investigate the issue and summon aggrieved persons/parties to produce the evidence and explain their claims; and resolve the grievances within stipulated time frame preferably in 30 days;
- Communicate its decisions and recommendations on all resolved disputes to Project executors and the aggrieved persons for implementation and follow the implementation progress;
- Develop an information dissemination system and acknowledge the aggrieved parties about the development regarding their grievance and decision of PIU and PMU level;
- Maintain a complaint register accessible to the all stakeholders with brief information about complaints and GRC decision with status report; and
- Maintain complete record of all complaints received by the GRC with actions taken.

661. The GRC at PMU level will be composed of the following key members, but not limited to:

• Project Director/ Representative (PMU);	Chairman/Convener
• Director Technical (PMU);	Member
• Environmental/ Social Safeguards Expert (PMU);	Member
• Representative of Deputy Commissioner Office	Member
• Land Acquisition Collectors (BoR);	Member
• Representative of Project Implementation Consultant; and	Member
• Representatives from Displaced Persons Committee (DPC)	Member

662. The 50% quorum of the finalized GRC will have authority to conduct the meeting and take decisions accordingly.

8.6 INFORMATION DISSEMINATION AND COMMUNITY OUTREACH

663. In synchronization with on-going consultative process the grievance redress mechanism will also develop an information dissemination system to inform the DPs about their

rights under the notational statutes (LAA 1894 including Sindh Amendment 2009) and Environmental Social Management System (ESMS) provisions, and approved LARP for the Project. The DPs will be informed about the GRM, its functioning, complaint process to GRC and Environment Social Safeguards Unit (ESSU) at PMU, contact details of the focal members of the GRM at both levels. The GRC will send acknowledgement to complainants about receipt of complaint and to inform him about its site visit plan to ensure complainant is present during site visit and provide update on the progress made to resolve his complaint/ grievance. Besides this formal communication, the Resettlement Specialist, Land staff and the social mobilizers of PMU in the field will maintain a close liaison with the complainants through DPCs at Site level and provide them the requisite information on the GRM and updates about the status of complaints under process with GRC or the ESSU whatsoever the case may be.

664. The aggrieved DP(s) will be kept informed about the actions on his/her complaint throughout the grievance resolution process and the aggrieved persons will be facilitated to attend and participate in the proceedings at different levels of grievance resolution process. Grievance flow mechanism and resolution process is summarized in the **Table 8.1 and Figure 8.1**.

665. The typical grievances associated with the environmental and social aspects of the proposed Project are likely to include but not limited the following:

- Land Acquisition and Resettlement;
- Dust, noise and air pollution from construction activities;
- Intensive schedule of construction activities;
- Inappropriate timing of construction vehicle and machinery flow;
- Traffic movement;
- Water pollution;
- Waste (Construction & Municipal) disposal;
- Tree cutting; and
- Open dumping of construction material

Table 8.1: Grievance Redressal Process

Land/Crop Compensation Grievances	Project/ Other Grievances
a. First, complaint resolution will be attempted at site (field level) through the involvement of the PIU/informal committee. b. If unsettled, grievance can be lodged to the GRC or DO (Revenue)/LAC to proceed under law and communicate decision in least possible time. c. GRC will acknowledge the complaint within 5 days of complaint and after initial review and consultation with the LAC, within 15 days of receipt of complaint, the GRC will clarify the legal course of action and guide aggrieved persons to approach appropriate legal forum. PIU will coordinate with the land administration authorities including District Collector and LAC to request early resolution of the issue/complaint. d. In case grievance pertains to awarded compensation, the complainant will be clarified on the process set out in Section 18 to 22 of the LAA 1894.	a. First, complaints resolution will be attempted at site (field level) through the involvement of the PMU/informal committee. b. If unresolved, a grievance will be lodged to the GRC, which will acknowledge receipt of the complaint within 5 days. c. The GRC will conduct fact finding in 15 days of receipt of complaint and after review of fact findings reports and hearing the DPs in person will conclude its recommendations in 30 days of receipt of complaint. In case GRC could not decide in stipulated time, the reasons if any will be recorded and the grievance will be resolved in next 30 days. d. If the complainant is not satisfied, he can pursue further by submitting to the appropriate court of law.

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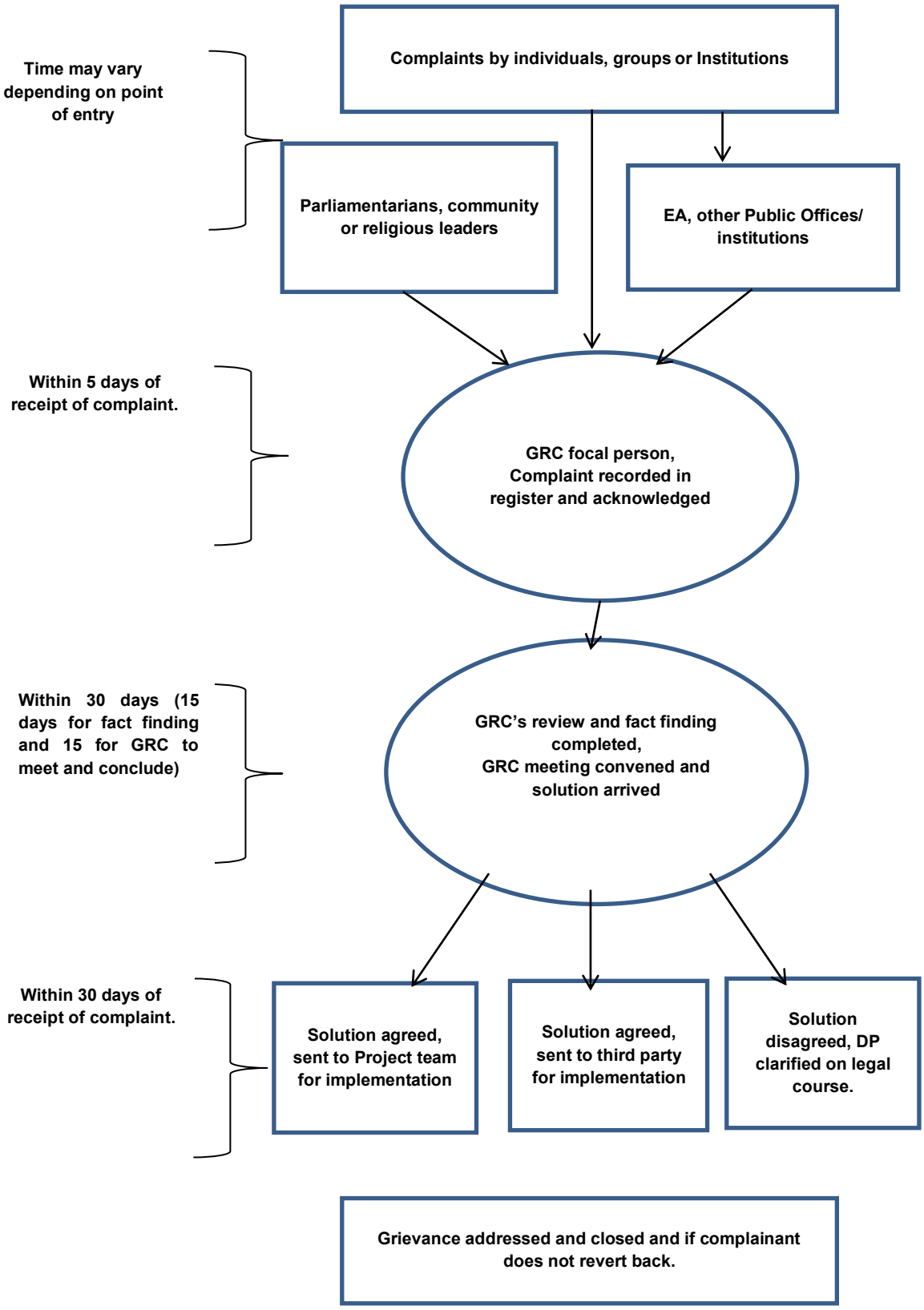


Figure 8.1: Grievance Resolution Flow Mechanism with Time Frame

9 ENVIRONMENTAL MANAGEMENT PLAN

9.1 GENERAL

666. The Environmental Management Plan (EMP) is a tool for the implementation of all the suggested mitigation measures to make the Project environmentally sustainable. It provides an overall approach for managing and monitoring the environmental, ecological and socio-economic impacts arising out of the implementation of the proposed Project, and describes the institutional framework and reporting mechanism to implement EMP for the Project.

9.2 EMP COMPONENTS

667. The EMP comprises following main components:

- EMP Objectives;
- Scope of the EMP;
- Environmental Policy, Legislation and Framework;
- Institutional Requirements;
- Environmental Mitigation and Management Matrix;
- Environmental Monitoring Plan;
- Planning for EMP Implementation;
- Training and Capacity Building;
- Communication & Documentation;
- Management Plans;
- Chance Find Procedure;
- Public Disclosure;
- EMP Cost; and
- Summary of Environmental Cost.

9.3 EMP OBJECTIVES

668. The main objectives of the EMP are:

- Provide Project impacts with the proposed mitigation measures, and a corresponding implementation mechanism;
- To ensure that all necessary corrective actions are carried out in time to counter any adverse environmental impact;
- To ensure the regular monitoring of those factors which may affect the safety of the environment under a systematic monitoring approach;
- Define the roles and responsibilities of the Project Proponent and Contractor(s) in order to effectively communicate environmental issues among them;
- Provide a procedure for timely action in the face of unanticipated environmental situation;
- Identify training requirements at various levels including Project Proponent, Contractor(s) and Supervision Consultant (SC);
- Provide a monitoring mechanism in the form of an environmental monitoring program, which includes monitoring parameters, monitoring frequency to ensure that all the mitigation measures are completely and effectively implemented;

- Provides estimation of environmental cost for the implementation of EMP;
- Define the requirements necessary for documenting compliance with EMP and communicating it to all the concerned regulatory agencies; and
- Provide other plans considering the Project specific requirements.

9.4 SCOPE OF THE EMP

669. The scope of the EMP includes the following phases of the proposed MEX Project:

- Pre-construction Phase;
- Construction Phase; and
- Operation and Maintenance Phase.

670. All the activities performed during these phases will be controlled and monitored according to this EMP.

9.5 ENVIRONMENTAL POLICY, LEGISLATION AND FRAMEWORK

671. The applicable polices, legislation, acts and guidelines are discussed in detail in Chapter 2 of EIA.

9.6 INSTITUTIONAL REQUIREMENTS

672. The institutional requirements for the construction and Operation & Maintenance (O&M) phases of the proposed Project are provided in below sections.

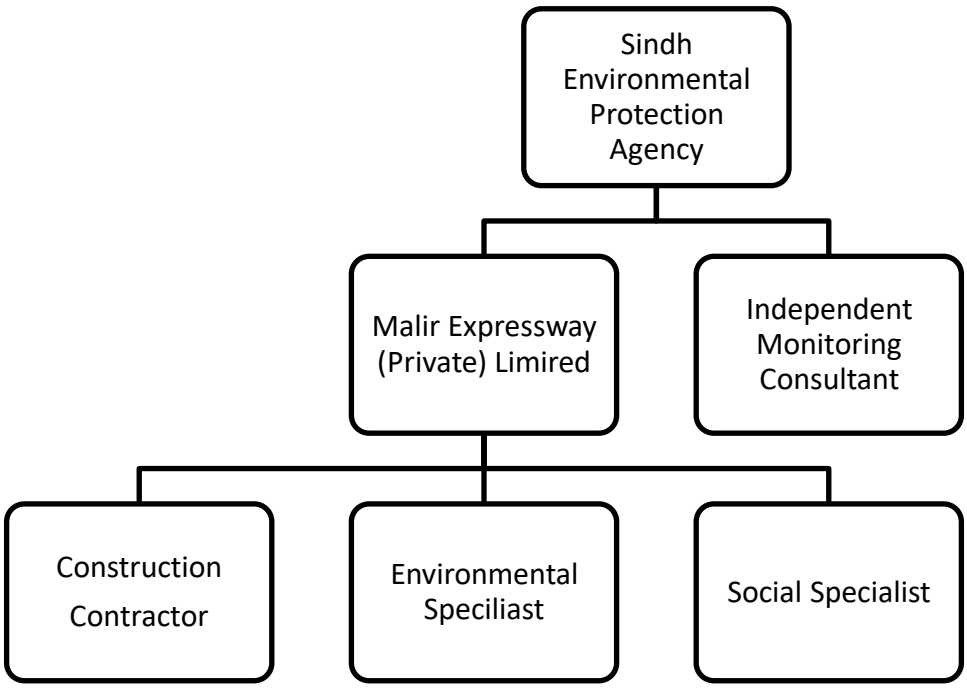
9.6.1 Institutional Arrangements for Implementation of EMP during Construction Phase

673. The key players involved during construction phase of the proposed Project for the implementation of the EMP are the Project concessionaire: Malir Expressway (Private) Limited, SEPA, the Third-Party Environmental Consultant (External Monitor) and the Contractor(s). The roles and responsibilities of these organizations are outlined below.

674. The following staff will be involved in the implementation of EMP:
- Malir Expressway Private Limited
- SEPA
- Third Party Environmental Consultant; and
- Contractor's Environmental Manager.

675. The concessionaire, Malir Expressway (Private) Limited will make Contractor bound through contract documents to implement the EIA including EMP and other terms and conditions of the Environmental approval issued from SEPA. The whole EMP will be included as a clause of the contract documents. Construction camps will be established after necessary approvals and submission of Site-Specific EMPs to be developed in the light of the relevant agencies' requirements before commencement of new works.

9.6.2 Roles and Responsibilities



a) SEPA

676. As per Sindh Environmental Protection Act, 2014, SEPA is responsible for environmental protection and pollution control. The agency is responsible for the approval of the EIA and IEE of all the developmental projects under their jurisdictions. SEPA will undertake audits (as and when required) of the proposed Project activities with respect to the protocols as defined in EMP.

b) Project Concessionaire - Malir Expressway (Private) Limited

677. The concessionaire for the project, in charge or implementation is the company 'Malir Expressway (Private) Limited, headed by the Project Director MEX. The general monitoring responsibilities will consist of:

- Ensuring that the required environmental training is provided to the concerned staff;
- To carrying out random site visits to the construction sites to review the environmental performance of the Contractor;
- Review monitoring reports for the progress of environment related activities;
- Make sure that the Contractor is implementing the additional measures suggested by the Monitoring Consultant in environmental monitoring reports;
- To assist Contractor for obtaining necessary approvals from the concerned departments;
- Maintaining interface with the other lined departments/stakeholders; and
- Reporting to the SEPA on status of EMP implementation.
- Any land acquisition and resettlement issues will be dealt under the LARP.

c) Third Party Environmental Consultant/ Independent Monitoring Consultant

678. Roles and responsibilities of third party environmental consultant will be:

- Carry out independent monitoring at critical locations during construction stage and monitoring the implementation of EMP at project area;
- Monitor GRM and resolution of complaints;
- Observe and amend/prepare (if required) of corrective action plans; and
- Monitor plan implementation along with Project Implementation Consultant.

d) Construction Contractor

679. Contractors will be bound to appoint site based Environmental Manager with relevant educational background and experience for each construction camp. Contractors' Environmental Manager will carry out following activities:

- Implementation of the mitigation measures at construction site;
- Contractor will be bound through contract to take actions against all the special and general provisions of the contract document;
- Contractor will make sure the compliance of EMP recommendations and will also be responsible for effective liaison with local heads of villages;
- Provision of proper Personal Protective Equipment (PPEs) to the workers and train them for their proper use;
- To conduct the environmental and health & safety trainings to the workers/labor; and
- Coordinate with Environmental Specialist of concessionaire.

9.6.3 Institutional Arrangement for Implementation of EMP during O&M Phase

680. The proposed Project will be administrated by the Concessionaire during the O&M phase. The Project Director and his staff (designated Environment and Social Expert) will be responsible for the following:

- Coordinating with the operational staff working under the Regional General Manager to monitor environmental compliance during operation;
- Advising on, and monitoring tree plantations along the MEX;
- Reporting on the progress of environmental compliance to SEPA;
- Assessing the long-term environmental impacts of MEX operation;
- Sustaining a working partnership among the, SEPA, Agriculture, Irrigation, Forest and Wildlife departments of Sindh, NGOs and other related public private sector organizations; and

9.7 ENVIRONMENTAL MITIGATION AND MANAGEMENT MATRIX

681. Environmental Mitigation and Management Matrix (EMMM) is considered as one of the main elements of EMP. It will be used as the management tool for the implementation of mitigation measures. The plan includes following:

- The envisaged impacts as identified in EIA and their recommended mitigation measures; and
- The person/organization directly responsible for adhering to or executing the required mitigation measures.

682. It is highlighted that although the responsibilities for executing and monitoring the mitigation measures have been delegated to different organizations, however, the Concessionaire will hold the primary responsibility for ensuring the full implementation of EMP. **Table 9.1** provides information about all impacts to be raised due to Project activities during different phases of the Project i.e. pre-construction, construction and O&M.

Table 9.1: Environmental Mitigation and Management Matrix

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
Preconstruction / Design Phase					
1	**Permanent Land Acquisition** The proposed MEX will be constructed on an alignment for which land acquisition will need to be carried out. An initial survey indicates that over 120 acres of private land will require acquisition.	Compensation should be made to the affected people as per Land Acquisition Act, 1894. Adequate budget will be provided in the Project cost for this compensation. Land Acquisition and Resettlement Plan (LARP) shall be prepared for the acquisition and compensation strategies as per National and Provincial laws.	• Compensation and land acquisition records • Implementation record of LARP	District Government Malir and Korangi	Proponent
2	**Renting/Leasing Land** The development of Contractor camps and facilities i.e. storage, workshops, equipment parking and washing areas; aggregate quarries; and access roads/tracks for haulage, transportation etc. will required renting/leasing land.	Land for above mentioned facilities will be directly rented from the private landowners by the Contractors. Rental terms should be negotiated to the satisfaction of the concerned landowners and the agreement should be in local language to make the process clear. Mitigation mentioned in Section 7.6.1.2.	• Compensation and land lease records	District Government Malir and Korangi	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
4	**Loss of Agriculture Land** Due to the proposed Project, over 230 acres of agricultural land, where Lucerne, vegetables and fodders are cultivated, will be affected and crop yield will be disturbed.	• Agricultural Land that will be coming under ROW should be acquired as per market rates which will be defined in LARP of the proposed Project.	• Confirmation of design incorporation. • Compensation records • Audits and Checks	District Government Malir and Korangi	Proponent
5	**Flora** During the pre-construction phase, activities such as installation of construction camps, construction of temporary roads & mobility of construction staff may damage the local vegetation/trees. It is initially examined that approximately 1800-1900 mature, sub-mature, and pole crop and saplings of different tree/plants species will be removed.	• The camps, mobility of machinery and construction of temporary road should be properly planned and well designed to avoid any loss to local green cover. • A tree plantation program shall be formulated with the recommendations and technical support of concerned Agriculture and Forest Department.	• Conformation of design incorporation • Checks and audits of suitable place • Tree compensation record	CC, Design Consultant	Proponent
6	**Change in Hydrologic Regime** The proposed road will cross four (04) numbers of nullahs (including one main tributary of Malir River near RD 34+200),	For the crossing of nullahs, drains and other structures, box culverts, pipe culverts and bridges will be constructed.	• Confirmation of design incorporation. • Audits and Checks	CC, Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	numbers of sewerage and storm water drainage outlets/network There might be change in water flow pattern and disturbance to water flow occurred which will cause impact on downstream of these water bodies.				
7	**Public Utilities** Public utilities will be affected and creating disruption of public services and inconvenience to the local residents due to proposed MEX. Various utilities such as electrical poles of 11kV transmission lines, telephone lines and tube-wells /wells are situated within the CoI of the proposed MEX. The proposed road will cross High Voltage transmission lines (220 kV and 500 kV) at RD 00+250, 00+625 12+400, and 25+750 locations. These utilities will be relocated before the start of construction activities. These utilities if not handled properly will cause difficulties to the peoples of Project Area	• Proper compensation and restoration mechanism of public utilities will be considered. • Close coordination with the concerned departments to curtail inconvenience to the residents of the Project Area. • Timely public notification of unexpected disruption of services. • Mitigation mentioned in Section 7.6.1.7 shall be followed.	• Confirmation of design incorporation. • Work order issuance after prior meeting and issuance of prior notification to public and concerned department. • Audits and Checks	CC, Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
8	**Resource Conservation** Resources involved in the construction of proposed Project would include water, fuel and construction materials. Excessive water consumption, non-renewable construction material, and fuel for energy will cause stress on these resources.	• A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels. • The efficient and well maintained equipment and machinery should be used; • Reuse of construction waste materials may be adopted wherever possible; Mitigation mentioned in Section 7.6.1.9 shall be followed.	• Confirmation of design incorporation. • Audits and Checks	CC, Design Consultant	Proponent
9	**Seismicity** The Project Area is located in Seismic Zone 2B, where 2B (upper limit of moderate damage) represents peak horizontal ground acceleration from 0.16 to 0.24 g.	The proposed road and the associated structures should be designed and constructed as per Seismic Building Code of Pakistan 2007 (SBC-07) to comply with minimum requirements for seismic safety of structures.	• Confirmation of design incorporation. • Audits and Checks	CC, Design Consultant	Proponent
10	**Fauna** As movement and installations of machinery and vehicles will take place so noise and habitat loss is expected. The routes of the available	• The standard measures must be adopted to minimize noise due to machinery movements and installations. • Wildlife movements and routes must be considered during activities and should be avoided to their maximum level.	• Confirmation of design incorporation • Checks and audits of suitable place	CC, Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	wildlife and other habitats may be affected due to camps set-up and machinery movements and installations.	• The camps shall be properly fenced and gated to check the entry of animals in search of eatable goods.			
	Construction Phase				
1	**Temporary Access Roads** The proposed MEX is approachable through major roads as mentioned in Section 7.6.2.1. Apart from above existing road, few accessibility tracks needs be developed which may cause damage to trees and crops, soil erosion, soil contamination, air and noise problems.	• According to usual practices during the construction of road, the access road will be developed within the RoW of the proposed road. Mitigation mentioned in Section 7.6.2.1 will be followed.	• Regular observation and photographic record of transportation route, • Road/track repair records, • Compensation records for damages of crop, trees and other infrastructure (if happens)	CC	Proponent
2	**Traffic Management** Due to the proposed construction activities and movement of heavy Project vehicles for construction material supply; traffic problems may arise for the commuters and transporters travelling to the proposed areas.	• Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime. • Traffic Management Plan will be implemented to avoid traffic accidents, jams/public inconvenience.	• Vehicle maintenance record • Training record • Implementation of TMP • Regular visual observations	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	The movement of vehicles along the haulage routes will cause soil erosion, debris flow, dust emissions etc.	Mitigation mentioned in Section 7.6.2.2 shall be followed			
3	**Community Health and Safety** The construction activities and vehicular movement at construction sites may result in roadside accidents deteriorate quality of groundwater and surface water resources, cause air/dust emissions, noise pollution, vibrational impact and spread of different transmittable diseases due to outside labour	Proper control on construction activities, restrict entry of labors with different transmittable diseases, adopt mitigations for dust, noise & vibration impacts and create awareness about road safety will be ensured. Mitigations mentioned in section 7.6.2.3 will be adopted.	• Implementation of HSE Plan • Use of PPEs • Community concerns record • Medical reports of worker	CC	Proponent
4	**Occupational Health and Safety** Occurrence of accidents / incidents and other natural emergencies during the construction stage is a common phenomenon and workers as well as locals will be more prone to serious accidents.	Safety precautions for the construction workers, Training of workers in construction safety procedures and use of Personnel Protective Equipment (PPE) will mitigate this impact. Mitigations mentioned in section 7.6.2.4 will be adopted.	• Implementation of HSE Plan • Use of PPEs • Training Records • Work permits • Implementation of Emergency response plan and disaster management plan in case of natural disaster occurrence	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
5	**GHG Abatement** The main sources of greenhouse gases (CO_2, CH_4, NOx etc.) during the construction activities of the proposed Project will include both mobile and stationary sources. Emission of greenhouse gases cause global warming and other climatic changes on regional and global scale.	SEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works. Alternative energy resources shall be considered where possible. Plantation development as per the tree plantation/reforestation plan is highly recommended for the sequestration of CO_2 and vehicle maintenance protocol will be adopted.	• Regular environmental monitoring, sampling and testing reports • Vehicle inspection record • Plantation record	CC	Proponent
6	**Ambient Air Quality** Airborne dust from access road construction and use, wind erosion of material stockpiles, emissions from diesel vehicles and construction equipment, disposal of waste have potential to adverse impact sensitive receptors in the Project Area.	• The following effective measures need to be adopted for controlling the potential adverse impacts on ambient air quality: • The existing quarries will be used to borrow the aggregate materials; • Concrete batching plants will be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce the level of dust emissions; • Ensure the proper and periodic tuning of the vehicles; • Dust emissions from trucks will be reduced by a regular sprinkling of water for keeping the dust settled at least twice a day;	• Visual observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records • Water sprinkling records.	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		• Haul-trucks carrying sand aggregate and other materials will be kept covered with tarpaulin to reduce the dust pollution; • Turn off the engines for all vehicles, while parked on the site; Regular monitoring of air quality in accordance with SEQS.			
7	**Noise and Vibration** Noise and vibration generated by the construction machinery during the construction stage is likely to affect the CoI particularly the sensitive receptors like nearby schools, houses and settlements etc.	• There are a variety of ways by which construction equipment and worksite noise can be controlled. Mitigations mentioned in section 7.6.2.7 shall be adopted.	• Physical observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records	CC	Proponent
8	**Soil Erosion** Construction activities such as clearing of earth, levelling, compaction, carpeting, pavement finishing will affect the existing soil condition in the CoI. Soil erosion may also occur in the workshop areas as a result of improper drainage system of equipment washing-yards and	Good engineering practices will help to control or minimize the soil erosion both at the construction sites and in peripheral areas. All the disturbed areas need to be protected against soil erosion by stripping and stockpiling of all the available topsoil for later re-vegetation. Special slope protection measures will be adopted in the sensitive areas and along the	• Visual observation and photographic record • Site restoration and rehabilitation plan implementation	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	improper management of construction activities.	shoulders of roads. Site restoration plan for the Project will be strictly followed.			
9	**Soil Contamination** Land may be contaminated due to the spillage of chemicals, fuels, solvents, oils, paints, concrete, solid waste generated at campsites etc. This normally happens when these materials are transported in open or loosely capped containers. The possible contamination of soil by oils and chemicals at camp sites, workshop area and equipment washing-yards may limit the future use of land for agricultural purposes.	• The Contractors will be required to instruct and train their workforce in the storage handling and management of materials and chemicals that can potentially cause soil contamination; • Material Safety Data Sheets (MSDS) will be strictly followed during handling and storage of chemicals; • Soil contamination due to concrete transportation and solid waste will be minimized by placing all containers in casings; and	• Visual observation and photographic record • Waste Management plan implementation	CC	Proponent
10	**Wastewater Generation at Construction Camps** Wastewater will be generated at the construction camps (total 03 in Nos. and from construction activities. Based on the estimated, 28,800 liters/day wastewater will be generated from camps during the	• To dispose the liquid waste generated from the construction activities, the following steps will be taken by the Contractor: • Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks (as shown in Figure 7-9). Proper monitoring to check the	• Visual observation • Regular environmental monitoring, sampling and testing reports • Waste Management plan implementation	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	construction phase which may affect water bodies if disposed off without proper treatment.	compliance of SEQS will be carried out; and • Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit.			
11	**Solid Waste Generation at Construction Camps** Considering the labourers (about 900 Nos.) residing in the construction camp and the locally available labour, a total of about 450 kg of solid waste will be generated from the construction camp daily. The major components of the labour camp waste will be garbage, putrescible waste, rubbish and small portion of ashes and residues. Other type of wastes may include inorganic construction wastes.	• All the solid waste from the camps will be properly collected at source and disposed of through proper solid waste management system. The Contractor will coordinate with local representatives and administration concerned department for the disposal of solid waste; • The concerned department must develop a plan of action for transporting the waste to the disposal site for final disposal. It is the responsibility of the concerned department to ensure that the disposal site is properly lined to prevent the leachate from contaminating the groundwater; • Secondly, the disposal site must be located away as far as practical from populated areas and regions that have a high density of Wildlife; • Toxic waste will be handled, stored, transported and disposed	• Visual observation and photographic record. • Waste Management plan implementation	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		separately through SEPA certified contractors; • The waste will be properly sealed in containers with proper labels indicating the nature of the waste; and • Solid waste will be segregated at source so that it can be re-used or recycled.			
12	**Waste Generation at Construction Site** The construction waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials etc.). The handling and storage of oil and other hazardous waste will be a source of environmental pollution during the excavation, foundation, levelling, carpeting and pavement activities.	• Waste Management Plan will be developed to implement an efficient and responsive solid waste management system during construction phase.	• Visual observation and photographic record. • Waste Management plan implementation	CC	Proponent
13	**Borrow Pits** Borrow pits and its excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of	• Necessary permits will be obtained for any borrow pits from the competent authorities. • In borrow pits, the depth of the pits will be regulated so that the sides of	• Visual observation and photographic record • NOC record of permits • Check and audits	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	vegetation, landscape degradation, and damage to road embankments. Borrow pits may also become potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife. This will also degrade hygienic condition of the Project Area.	the excavation will have a slope not steeper than 1: 4; • Soil erosion along the borrow pit will be regularly checked to prevent/ mitigate impacts on adjacent lands; • In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and Borrow pits will be used for construction waste, but during the excavation, top 20 cm soil cover will be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area.			
14	**Impact on Water Resources (Surface and Groundwater Contamination)** The proposed MEX will also cross the numbers of nullahs and drains at different locations. The bridges and culverts are proposed on these water resources these surface water resources may get contaminated by the fuel and chemical spills, or by solid waste and effluents generated by the	As a mandatory step, all the effluents will be disposed as per the requirements of SEQS. Moreover, to reduce the risk of surface and groundwater contamination, good management practices will be adopted to ensure that fuels, chemicals, raw sewage and wastewater effluent are disposed of in a controlled manner. Mitigations mentioned in section 7.7.2.14 shall be adopted.	• Visual observation • Regular environmental monitoring, sampling and testing reports • Waste Management plan implementation	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	kitchens and toilets at the construction camp sites. Moreover, runoff from the chemical storage areas may also contaminate the surface water bodies.				
15	**Flora** The Project will involve destruction of vegetation cover on construction areas particularly along proposed road construction.	• Cutting of trees and disturbance of orchards shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized and possible alternate route must be considered for proposed road, in which minimum ecological and environmental losses are expected. • A tree plantation program shall be formulated with the recommendations and technical support of concerned Agriculture and Forest Department.	• Tree compensation record • Visual observations • Regular monitoring, audit and checks	CC	Proponent
16	**Fauna** During construction phase the existing population of mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving excavation, blasting, movement	• Care shall be taken during construction activities for avoiding purposely or chance killing of animals. • If found any wild species and habitat during construing that must dealt carefully and local wildlife department officials should be called.	• Departmental consultation record • Visual observations • Regular monitoring, audit and checks	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	of machinery and vehicular traffic, movement of labor, camping, etc.	• Special measures should be adopted to minimize impacts on birds such as avoiding noise generating activities during the critical period of breeding. • Hunting, poaching and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labor force accordingly and clear orders should be given in this regard.			
19	**Aquatic Fauna** There is no direct impact on fish in the Project Area as there is no fish reported in the Project Area.	• Proper arrangements must be made to control the wastes from machinery & equipment used at site during the construction phase.	• Departmental consultation record • Visual observations • Regular monitoring, audit and checks	CC	Proponent
20	**Social Impacts** • Social and Cultural Conflicts;	• Local labor especially from nearby communities should be given preference for the construction works; • Careful planning and training of work force to minimize disturbance to the local people; • Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals; and	• Record register of all the issues and rational expectations desired by the local public; • Camp established away from the nearest community; Local hired workforce;	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	• Health Impacts (Communicable Diseases)	• Adequate training of especially for the transitive workforce of the station (involved both in the construction process and in the commissioning) to regard the customs of the area so that the locals do not feel insecure. • Proper check-up of skilled and unskilled workers before their hiring; • Labour camp should be away from the residential area and workers' management plan should be formulated by Contractor to minimize the adverse impacts on local communities and workers; • Trainings, awareness and campaigns should be conducted for workers and surrounding communities on awareness and prevention of HIV/AIDs and COVID-19; • Workers should be educated for personal hygiene and the sanitation concerns, leading to communicable and non-communicable diseases; • Water should not be allowed to stagnate even if clean, and measures should be taken to cover the area; and	• Any complaint from the local community. • Approved OHS Plan, evidence of OHS trainings conducted. Accident/Incident reported. • Training records Health and safety manual • Contractor will implement the SOPs related to the Construction industry. • Health and safety manual.		

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		• Insecticides should be periodically sprayed.			
21	**Influx of Labor** Social problems and conflicts that are associated with Labor Influx are Risk of social conflict, Increased risk of illegitimate behavior and crime, Impacts on community dynamics, Local inflation of prices, accommodations and rents, Increase in traffic and related accidents, etc.	• Labor camp(s) should be established away from residential population; • Preference should be given to the local people to work with contractor, and contractor should hire maximum labour force from the Project Area because this will reduce the labour influx; • An effective GRM should be established for the Project to resolve all issues related to the community. Thus, progress regarding resolving the issues should be monitored closely; • Mitigations mentioned in section 7.6.2.21 shall be adopted.	• Minutes of meetings of community Consultation Dissemination relevant material.	CC	Proponent
22	**Religious, Cultural, Historical Sites** No notified religious, archaeological, cultural and historical sites are located within the CoI including RoW of the proposed MEX. Hence, insignificant impact on the notified archaeological site has been assessed during the	• No notified archaeological site will be affected due to the implementation of the proposed Project. However, the Contractors will be required to train the construction crews and the site supervisors in archaeological site recognition, conservation procedures and temporary site protection. • In case of a chance archaeological find during excavation, the	• Record Register • Consultation record of Archaeological Department	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	construction of the proposed Project.	Contractors must halt work at the site immediately and notify the Department of Archaeology and Museums through Project Director.			
23	**Gender Based Violence (GBV)** The Project route is passing through the urban and semi urban areas where women are involved in working activities. During construction phase gender based violence might arise due to discrimination made against women by unequal work distribution and unequal pay structure among others. Sexual harassment against women might occur as a consequence of mixing of men and women at the construction site, and moving on the roads, bus stops and markets. Educational institutions near the Project alignment are also sensitive regarding gender issues.	• Awareness should be created among the females at individual and community levels about the constructions sights; • The Contractor should make sure that no discrimination is made on the basis of gender while hiring of workers; • Raise awareness among the communities of the potential risks of GBV, and establish response services in the communities that can respond to instances of GBV (particularly those related to issues of labour influx); • Contractor should take proper measures to address and resolve issues relating to harassment, intimidation, and exploitation, especially in relation to women.	• Grievance redress record • Minutes of meetings of community/ gender consultation	CC	Proponent
24	**Child Labor** Inhabitants of the Project Area have mix economic background and different sources of income.	• Awareness should be created among the local communities about the adverse impacts of child labor.	• Compensation record. • Grievance redress record	CC	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Children of low income groups mostly involve in different earning activities, as their parents prefer to get their children hired in small shops as helpers, and waiters in hotels for earning money, and supporting household livelihoods.	• Contractor through contractual agreement should be bound to follow the labor standards, rules and regulations during hiring the labor force and all activities should be monitored by the social and environmental staff of the implementing agency; • Contractor should ensure the presence of all persons at site are adults and have their proper identity cards with them.			
Operation and Maintenance Phase					
1	**Air Quality** Improvement in road condition will help reduce traffic related emissions in the short term by allowing a smoother traffic flow. However, in the longer run, increased traffic levels may lead to higher values of emissions. The impact is permanent. It is positive in case of improvement of road conditions; and minor negative, when traffic volume increases.	• Proponent with the help of SEPA may set up system to monitor air quality along Project Area in accordance with SEQS for a specific period to record the quality of air during the operation phase. • Mitigations mentioned in section 7.6.3.1 shall be adopted.	• Visual observation • Regular environmental monitoring, sampling and testing reports.	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Air Modelling was carried out by using CALROAD to assess the impact which is discussed in Chapter 7.				
2	**GHG Emissions** Vehicle traffic on the proposed expressway alignment will result in emissions of GHG from fuel combustion during the operation phase. Total GHG emissions from the MEX traffic is 13,740 tCO_2e/day and 59,118 tCO_2e/day for 1st and 20th year of proposed traffic respectively. As this traffic is diverted from the other routes of the Karachi, therefore, the emissions are not considered to be substantive and are not likely to result in overall Change in GHG Emissions of whole city / project area / surroundings. If anything, this will lead to lesser traffic congestion and traffic jams where cars produce more emissions.	• Mitigation of air quality and traffic management will help to mitigate the impact of GHG emissions.	• Visual observation • Regular environmental monitoring, sampling and testing reports.	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
3	**Noise and Vibration** Noise and vibration not expected to be as great as they are in the case of traffic congestion in the city.	• Provision of adequate noise barriers such as hedges and indigenous tree species will reduce the noise. Further Improvement can be made by enforcing the laws and getting the vehicles tested, regularly after a specific time period, by some reputable vehicle testing laboratory and obtaining a certificate. • Mitigations mentioned in section 7.6.3.3 shall be adopted.	• Physical observation • Regular environmental monitoring, sampling and testing reports.	Proponent	
4	**Road Safety** Enhanced vehicular movement and speed in the long run may result in road safety issues like traffic accidents. This impact is permanent but moderately adverse in nature, since the frequency of accidents may be lowered, but their intensity may be quite severe due to enhanced speeds at which vehicles will move.	• Strict enforcement of speed limits, installation of speed guns and channelization of traffic with respect to categories (heavy vehicle traffic and light vehicle traffic), should be ensured for the smooth flow of traffic moving from major road crossings. Enforcement of penalties for the violators will reduce the significance of this impact.	• Road safety enforcement record • Challan / penalties record • Accident record • Audits and check regularly	Proponent	
5	**Drainage**	• The impact can be controlled/reduced by timely and	• Maintenance and cleaning record	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	During the operational phase, poor maintenance of the road drainage system, particularly during the monsoon season can cause nuisance to the travelers and public due to flooding in the existing drainage line. In case of chocking of road drainage, the increased surface runoff due to heavy rains will accumulate at the start and end point of the proposed MEX and can cause traffic jams.	continuous maintenance/ cleaning of the drainage system; and • Placement of sign boards instructing not to dispose of solid waste to avoid chocking of drain around the flyover and at grade road alignment.	• Audits and check regularly		
6	**Road Maintenance Works and Heavy Traffic** During the operational phase, different maintenance works will be carried out throughout the Project life. Laborers or the staff involved in these maintenance works are exposed to health and safety issues.	• Implementation of HSE Plans during the maintenance period; • Strict implementation of personal protective equipment's PPEs; • Understanding and training of staff on Operation and Maintenance Manual; • Mitigations mentioned in section 7.6.3.5 shall be adopted.	• Physical observation • Regular monitoring, audits and check reports during work.	Proponent	
7	**Fauna** There is no protected area, Game reserve, Game sanctuary or national park in the Project Area so no major impact on	• The pathways of locally available wildlife and livestock for food, shelter and other normal activities must be compensated with proper alternative routes/pathways & water points must be provided to minimize	• Physical observation • Regular monitoring, audits and check reports.	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Wildlife & Livestock in the area is expected through, noise, vibration and any type of normal activity in the Project Area, thus will have no effect on productivity.	the impact and movement of available wild and domesticated animals. This has been done through provision of cattle creeps			
8	**Flora** During Operational stage the Project will not affect Flora (Trees and agricultural crops) or release any significant pressure detrimental to flora. Low level impact is expected at operational phase on Flora due to the Operational and Maintenance activities.	• The implementation of plantation plan recommends in compensation for cutting of trees should start working during operational stage, to ensure the ecological balance and to avoid any impact on local Environment. • Large scale planting with suitable indigenous fruit and forest trees, shrubs and ornamental plants in the form of Tree Groves, and Linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation.	• Physical observation • Regular monitoring, audits and check reports.	Proponent	
9	**Changes in Land-use** Road transport network development has significant impact on land use patterns. Once access has been provided, land patterns begin to	• Redefining basic land use allocation standards; • Improvements in the design considerations of proposed road alignment so as to promote sustainable development of commercial areas; and	• Physical observation • Regular monitoring, audits and check reports during work.	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	change over a period of time. The results of these changes are irreversible.	• Land use policies such as development restrictions and zoning codes (residential or commercial) and implementation of related By-Laws.			
10	**Landscape** During the operation stage, new saplings of different plants and trees would be planted to enhance the aesthetics and compensate the loss of affected trees. The presence of adequate flora at available spaces along the proposed alignment will help in absorbing flue gases, emitting from a large number of vehicles and public transport passing through the Project Area, which shall help improve the air quality.	• This will have a positive impact of permanent nature. • The saplings planted in the Project Area against the trees affected should be properly maintained	• Monitoring of plant maintenance activities records	Proponent	
11	**Change in Aesthetic Value** Construction of the proposed road, interchanges, bridges and culverts, will change the aesthetic value of the area. Proper landscaping and plantation of grasses and ornamental plants along the	• No mitigation required	• Physical observation • Regular monitoring, and check for any negative disturbance.	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	alignment will increase the aesthetic value of the proposed Project Area and will have a positive impact.				

9.8 ENVIRONMENTAL MONITORING PLAN

683. Environmental monitoring provides timely and useful information to the Project management and implementation agencies. Conceptually, "monitoring" means to check and balance, on a regular basis, the status of the Project activities and realization of various developmental targets during construction, operation and maintenance. It helps in timely identification/analysis and removal of the bottlenecks and expedites actions. Certain environmental parameters (physical, ecological and social) are selected and quantitative analysis is carried out. The results of analysis are compared with the guidelines; standards and pre-Project condition to investigate whether the EMP and its implementation are effective for the mitigation of impacts or not. The objectives of environmental monitoring plan during the construction and O&M phases will be as follows:

- Monitor the actual Project impacts on physical, ecological and socio-economic receptors;
- Recommend mitigation measures for any unforeseen impact or where the impact level exceeds the anticipated level in the EIA;
- Ensure compliance with legal and community obligations including safety during construction and O&M phases;
- Ensure the safe disposal of excess construction materials, solid waste, water and wastewater and gaseous emissions;
- Appraise the adequacy of the EIA with respect to the Project's predicted long-term impacts on the area's physical, ecological and socio-economic environment;
- Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend improvements in EMP, if required; and
- Compile periodic incidents/accidents data to support analyses that will help to minimize future risks.

9.8.1 Monitoring Strategy

684. Under the proposed monitoring strategy, it is recommended that PMIU of MEX Project should be responsible for all the monitoring activities. All the findings and results in the form of monitoring report will be finally shared with respective SEPA. The monitoring program has been designed carefully considering the identified impacts mentioned in Chapter-7 and some additions or deletions probably in frequency may be taken up in this program after learning lessons from one-year operation of the Project through Change Record Register. **Table 9.2** provides environmental monitoring schedule for construction and operations stages of the proposed MEX Project.

Table 9.2: Environmental Monitoring Plan

Sr. No.	Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
1	Water Resources/ Water Quality	Compliance with all parameters as per SEQS 2014.	Proposed MEX Project. – Major receptor i.e. Malir river, residential areas etc. within the RoW/CoI. However, estimated sampling points are six (06) which will be verified at construction stage. Other proposed effluent discharge points are: – Contractors camps – Concrete preparation plants – Fuel (Petrol. Oil and Grease) products storages. – Vehicle and machines repairing and servicing yards.	Visual checks of laboratory activities Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Once before the start of construction by activity monitors, then repeated monthly during construction phase, and reported on quarterly basis during the construction. Bi-annually for at least one year during O&M.
2	Soil Contamination	Soil contamination, uncontrolled solid waste disposal activities at sites.	Proposed MEX Project. – Sites with severe contamination. Other proposed sampling sites are: – Construction Camp. – Equipment washing yards. – Spillage points of fuel, chemicals and lubricants.	Visual observations and checks of laboratory activities Sampling and laboratory testing for soil samples.	Once before the start of construction by activity monitors and reported on quarterly basis during the construction Bi-annually for at least one year during O&M.
3	Dust Emissions	Compliance with PM_{10} $PM_{2.5}$ per SEQS 2016	Proposed MEX Project. – Sensitive receptors within the RoW/CoI. Estimated sampling points are five (05) which will be verified during construction stage.	Visual checks of laboratory activities Onsite Ambient Air Monitoring equipment	Once before the start of construction by activity monitors, after which checked monthly, and reported on quarterly basis during the construction

Sr. No.	Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
5	Noise Pollution	Compliance with dBA Leq. as per SEQS 2014	Proposed MEX Project. – Sensitive receptors within the RoW/CoI. Estimated sampling points are five (05) which will be verified during construction stage. – Other proposed sampling sites are: – Construction camps. – Equipment yards.	Visual checks of laboratory activities Monitoring of noise level at site.	Once before the start of construction by activity monitors, then checked monthly and reported on quarterly basis during the construction Bi-annually for at least one year during O&M.
6	Fumes and gases	Monitoring of CO, CO_2, SOx, NO_x, HC and $PM_{2.5}$ PM_{10} and compliance with SEQS 2016 Vehicular emissions as per SEQS 2016.	Proposed MEX Project. – Major receptors within the RoW/CoI. Estimated sampling points are five (05) which will be verified during construction stage. – Emissions from the silencers of heavy machinery, trucks and other vehicles.	Visual checks of laboratory activities Onsite monitoring of ambient air quality will be preferred.	Once before the start of construction by activity monitors, then checked monthly, and reported on quarterly basis during the construction Bi-annually for at least one year during O&M.
7	Ecological Resources	Disturbance to natural habitat, uncontrolled floral cutting which can be avoidable.	Proposed MEX Project.	Visual checks to ensure that only marked trees are cut within the Project corridor. Monitoring of Wildlife / birds hunting.	Once prior to the start of construction Monitoring and reporting on quarterly basis during the construction stage.
8	Public Infrastructure	Disturbance or damage to public infrastructure	Proposed MEX Project. – Public infrastructures within the RoW/CoI. These structures will be	Random visits and consultations with AP's.	Prior to the start of construction.

Sr. No.	Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
			verified prior to the start of construction.		Reporting will be done based on LARP recommendation.
9	Community around the Project corridor	Use of common resources. Hindrance to mobility. Community health and safety	– Communities within the RoW/CoI.	Community consultations.	Prior to the start of construction and during the construction stage. Reporting will be done based on LARP recommendation.
10	Tree Plantation	Number and growth of trees planted	– Throughout Project Corridor	Monitoring of trees growth and fruition throughout project corridor	Bi-annual monitoring and reporting during the operation stage for first year.

9.9 PLANNING FOR EMP IMPLEMENTATION

9.9.1 NOC and Other Approvals

9.9.1.1 Provincial Revenue Departments

685. Under the national law, matters relating to the land-use and ownership are the provincial subjects and the revenue department of the concerned province is empowered to carry out the acquisition of private land or built-up property for public purposes, including on behalf of other provinces. For this purpose, the Revenue Department of GoS must lodge an application with the Sindh Government to depute a Land Acquisition Collector (LAC) and other revenue staff, who will be responsible for handling the matters related to the acquisition and disbursement of compensation.

9.9.2 Stakeholder Coordination

686. Notwithstanding the efforts so far put in for public participation, this activity will have to be pursued through the forthcoming implementation phases of the Project. In particular, the focus will be on the improvement and modification of the proposed intervention designs.

687. Participation mechanisms facilitate the consultative process and include information sharing and dissemination, disclosure, and participation of affected people and other stakeholders in the proposed Project related activities. In the particular social set-up of the Project Area, it is also important to involve the religious leaders as representatives of the public as well as part of effective communication process. They can provide a very effective medium to bring information to the affected male population through Friday prayers. Local business community, especially the affected one, should also be brought into the process of awareness and participation.

688. The related institutional arrangements should also be in place for continuous consultation throughout the process of planning and implementation.

689. The construction schedule will be established/updated before the commencement of construction work considering the activities specifically suggested in EMP for its implementation.

9.10 TRAINING AND CAPACITY BUILDING

690. To enhance the capacity of the Proponent as well as the Contractor, training will be imparted related to the environmental and social issues of the proposed Project, implementation of mitigation measures and the monitoring protocols and reporting mechanism will also be carried out.

691. In-house training for the Project staff including contractor, consultant and the supervisory staff of the Proponent will be ensured through the provision of one-day basic training

and one-day advanced training, covering environmental and social aspects of the development projects in general, and implementation requirements with emphasis on the roles and responsibilities of the proponent and the contractor staff while executing the environmental management and monitoring plan. The training protocols will include the following aspects:

- Procedures for monitoring the air quality parameters and measures to be adopted for avoiding or minimizing air pollution, particularly from the concrete batching plant, haul-trucks, etc.;
- Procedures for monitoring water quality parameters and measures to be adopted for avoiding or minimizing water pollution, particularly from the wastewater effluent generated from the workshops, machinery washing yards, and other obnoxious chemicals;
- Safe waste management and disposal practices;
- Safe noise levels from the construction machinery etc.;
- General housekeeping and cleanliness;
- Communicable diseases;
- Safety measures against hazards for workforce and the local communities arising from the construction activities; and
- Use of safety gadgets by the workforce.

692. A comprehensive training manual will be developed and implemented by the Contractor with prior consent of concessionaire's environmental staff.

9.11 COMMUNICATION & DOCUMENTATION

693. Communication and documentation is an essential feature of EMP. The key features of such mechanism are:

9.11.1 Data Recording and Maintenance

694. All forms to be used for recording information during the environmental monitoring will follow a standard format which will correspond to the data base into which all the gathered information will be placed. Check boxes will be used as much as possible to facilitate data entry. Tracking system will be developed for each form.

9.11.2 Database

695. The database may include the following information:

- Training programs;
- Staff deployment;
- Non-compliances;
- Corrective actions
- List of environmental data; and
- List of environmental data to be maintained:
  - Soil and land pollution;
  - Disposal of waste;
  - Water resources;

- Fuel oil and chemical spills;
- Vegetation record;
- Noise pollution;
- Air and dust pollution;
- Socio-economic data; and
- Ecological sensitivities.

9.11.3 Social Complaint Register

696. The Contractor will maintain a register of complaints record from local communities and measures taken to mitigate these concerns.

9.11.4 Photographic Records

697. Contractors will maintain photographic records during the implementation of the proposed Project. As a minimum, the photographic records will include the site photographs, all the roads, camp sites and monitoring activities, etc.

9.11.5 Non-Compliance of the EMP

698. The implementation of the proposed EMP involves inputs from various functionaries. The Contractor will be primarily responsible for ensuring implementation of the mitigation measures proposed in the EMP, which will be part of the contract documents. The provision of the environmental mitigation cost will be made in the total cost of Project, for which the Contractor will be paid on the basis of monthly compliance reports. However, if the Contractor fails to comply with the implementation of EMP and submission of the monthly compliance reports, deductions will be made from the payments to the Contractor claimed under the heads of environmental components.

9.11.6 Review of Recorded Data

699. All the data and communication recorded and maintained by the Contractor will be periodically reviewed and checked by the concessionaire and necessary action will be recommended to Contractor to improve the recording and documentation.

9.12 MANAGEMENT PLANS

700. Various management plans have been prepared as a part of EMP for the better management and implementation of EMP during all phases of the proposed Project. However, these plans will be updated by Contractor and approval from concessionaire should be sought before start of construction activities. These plans are listed below:

1) Tree Plantation / Reforestation Plan;
2) Health, Safety and Environment (HSE) Management Plan;
3) Emergency Preparedness and Response Plan;
4) Restoration and Rehabilitation Plan;
5) Waste Management Plan;
6) Disaster Management Plan;

7) Drinking Water Supply and Sanitation Plan
8) Traffic Management Plan;
9) Change Management Plan; and
10) Vibration Management Framework.

9.12.1 Tree Plantation / Reforestation Plan

701. The basic purpose of reforestation/afforestation/plantation of suitable species in the Project Area is to compensate for cutting of trees for the proposed Project and to enhance green cover and improve the overall environment of the area. Reforestation will not only reduce the risk been made but will also increase the carrying capacity of the area regarding many positive aspects.

702. Afforestation will be done in those areas in which there is low forest cover or in areas which have been clearly felled and leave barren. Afforestation is highly important to maintain the biodiversity and ecological balances. It is also important to prevent global warming, soil erosion and pollution. Afforestation purifies the environment and helps in reducing the carbon dioxide level. Along with the importance of proposed Project to the local communities, the afforestation activity will further help in enhancing the socio-economic condition of the local communities. The spacing of the plantings should be wide enough to prevent competition for soil moisture, or when part of management, to accommodate machinery used for irrigation.

703. Based on the estimation, total cost of approximately 19,500 numbers of trees/plants will be 37.67 million PKR. The details are attached as **Annex-XV**.

9.12.2 HSE Management Plan

704. Health risks and work safety problems may result at the workplace if the working conditions provide unsafe and/or unfavorable working environment due to storage, handling and transport of hazardous construction material. Workers should be provided with safe and healthy working environment taking into account risks inherent to the particular sector and specific classes of hazards in Project Area. During construction phase, Contractor will be responsible for all HSE related issues and to comply with national laws and international standards for occupational health and safety. Guideline for contractor's Occupational Health and Safety Plan is attached as **Annex-XIV**. The goal of the plan is to eliminate any injury to human and damage to facilities, materials and the environment.

705. The following measures are identified for health, safety, and environment protection during all activities of the proposed Project to minimize risk of accidents, which could endanger the life of personnel, cause damage to properties and environment:

- All contractor staff shall be well informed and trained on the HSE policies and guidelines;
- Contractor shall provide adequate health services as well as site first aid services for its workforce;

- The main priority of the contractor shall be to prevent accidents during mobilization, construction phase of the proposed Project. Prevention of workplace accidents during the construction activities will be achieved using approved work plan/instructions by the supervisors;
- Work safety measures and good workmanship practices shall be followed by the contractor to ensure no health risks for workers;
- Provision of adequate sanitation, washing, cooking and dormitory facilities;
- Proper maintenance of facilities for workers shall be monitored;
- Provision of protective clothing for laborers handling hazardous materials, e.g. helmet, adequate footwear for bituminous pavement works, protective goggles, etc. and contractor will ensure strict use of wearing these protective clothing during work activities;
- Elaboration of a contingency planning by the contractor at work site in case of major accidents shall be carried out. A comprehensive emergency preparedness and response plan should be developed and implemented at site;
- A site-specific fire-fighting plan also needs to be developed and implemented by Contractor during construction phase;
- Accidents shall be reported to and investigated by the Contractor. All personnel shall be encouraged to report all accidents/incidents and to cooperate in the investigation of such occurrence. A comprehensive accident/incident report should be produced to concessionaire for its review and necessary action;
- Adequate signage, lightning devices, barriers, and persons with flags during construction to manage traffic at haulage and access roads shall be conducted;
- The communicable disease of most concern during construction phase, like sexually-transmitted diseases such as HIV/AIDS, should be prevented by successful initiative typically involving health awareness, education initiatives, training heath workers in disease treatment, immunization program and providing health service;
- Reducing the impacts of vector borne diseases on long-term health effect of workers should be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease;
- All construction activities shall be properly managed through careful planning and the applicable and relevant HSE policies; and

9.12.3 Emergency Preparedness and Response Plan

706. Emergency Preparedness and Response Plan provides an overview of the procedures to mitigate and control the impacts on community, on occupational health and safety, on the environment and on the Project in the event of emergency situations and to respond in life threatening situations usually occurring suddenly and unexpectedly during the construction and operational phases of the proposed Project. The contractor will be responsible for the preparation of plan and implemented at site after prior review and approval from the supervisory consultant and proponent. Guideline for contractor's Emergency Preparedness and Response Plan (EPRP) is attached as **Annex-XVII.**

9.12.4 Restoration and Rehabilitation Plan

707. The implementation of the proposed Project would involve construction workers' camp for staff and laborers, establishment of fences around construction site, over usage of access roads for movement of heavy machinery/motor vehicles linking to various components of Project, offices, borrow/quarry areas, etc. During construction, these

activities could also result in accumulation of large amount of unused or spoil material at various sites such as at access roads, muck dumping sites, quarry sites, colonies, offices, etc. which will change the existing land cover in the Project area. After completion of the construction work, it is required to restore the disturbed area to its original conditions wherever it is possible that is the sole responsibility of the Contractor. Various engineering and biological measures have been suggested for the restoration of these areas:

- Top soil should be stored at designated areas before performing excavation activities at quarry sites (if these are agriculture land) and after the completion of all the construction activities, quarry sites (if applicable) and construction sites should be covered with the top soil to support the growth of plant species;
- The area should be planted with indigenous vegetation that would require the initial establishment of fast growing grasses along with annuals and perennials, nitrogen fixing herbaceous legumes and non-legume shrubs to increase the soil conditioning and to stabilize the Project site;
- Material stockpiles shall be removed as soon as the construction work will be completed;
- All the construction, toxic and hazardous chemicals/materials shall be completely removed from the site;
- All fencing and gates shall be removed and pits shall be backfilled;
- The reconstruction of interrupted drainage channels and pipes shall be carried out;
- Rehabilitation of affected roads should be carried out to avoid any inconvenience to the road commuters; and

9.12.5 Waste Management Plan

708. Management of solid and hazardous waste is one of the most important issues during construction phase of the Project. It is estimated that around 900 workers will be accommodated at construction camps (total of about 03 camp sites) during construction phase. As a general rule the water consumption will be about 40 liter/capita/day and will subsequently generate about 80% of this water as sewerage. Based on this water consumption, around 36,000 liter/day of water will be utilized for washing, cooking and bathing purposes at each camp site which will generate approximately 28,800 liter/day sewage at each the construction camp sites. In addition to that each construction camp site will generate about 450 kg/day of solid waste at site @ 0.5 kg/capita/day.

709. The major components of the workers' camp waste are garbage, putrescible waste, rubbish and small portion of ashes and residues, wastewater from camps toilets and washing yards, etc. The construction waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials, etc.). Insecure and unhygienic disposal of the wastes may cause degradation of soil, land and water resources. However, a criterion has been developed for the solid and hazardous waste management at site. The criterion for plan is as follows:

- All the anticipated solid wastes should be collected through a properly designed solid waste management system. Enough number of containers should be placed inside

the camps and within the construction area for the collection of various types of waste;

- These containers will help the component separation of various types of waste at source. Classification will be based on organic waste, recyclable waste, reusable waste (for resource and recovery) and waste for disposal site. Based on the conditions of the region, organic waste should be frequently collected to avoid odor problems;
- Recyclable, reusable and waste for disposal site should be collected twice a week and on alternate days and should be transferred to a properly designed disposal site;
- The special strategy for safe handling, storage and use of hazardous substances/material should be developed and ensured at site;
- The sewage system for camps shall be properly designed (pit latrines or, as required, septic tanks) to receive all sanitary wastewaters;
- Lined wash areas shall be constructed within the camp site or at site, for the receipt of wash waters from construction machinery;
- Medical waste and construction waste should be handled with care;
- The pesticide use shall not be allowed at site and for clearance of RoW;
- Construction waste i.e. waste concrete, bricks, cement, etc. should be disposed of at the designated areas; and
- Construction workers and supervisory staff should be encouraged and educated to practice waste minimization, reuse and recycling to reduce quantity of the waste for disposal.

710. Based on the above guidelines, Contractor(s) will be responsible for the preparation of Waste Management Plan before the commencement of construction activities and its implementation at site after the prior review and approval from proponent.

9.12.6 Disaster Management Plan

711. A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community ‘s or society ‘s ability to cope using its own resources. Disasters are of two types i.e., Natural and Manmade.

712. The flooding, earthquake, wind storms are the major disastrous phenomena in the region. The mountainous terrain makes the community as well as worker more vulnerable to disasters. The development of poor infrastructural measures, poses greater vulnerability risk in relation to the onset of potential disasters. In such cases, even a moderate disaster could bring devastating effects on communities.

713. The Provincial Disaster Management Authority (PDMA) of Government of Sindh are mandated for planning, implementing and coordinating all activities in case of the onset of a disaster. Therefore, there is a specific requirement for developing a plan that effectively responds to any Monsoon induced emergency. PDMA specialize in mitigation, preparedness and an organized response to a disaster. The most important role of PDMA lie in providing a platform to come together and strategize management and response to disasters and calamities.

9.12.7 Drinking Water Supply and Sanitation Plan

714. Separate water supply and sanitation provisions will be needed for the temporary facilities including offices, labor camps and workshops in order not to cause shortages and/or contamination. A Plan will be prepared by the Contractor on basis of the mitigation plans. The Plan will be submitted to the Supervision Consultant for their review and approval before contractor mobilization.

9.12.8 Traffic Management Plan

715. A comprehensive Traffic Management Plan (TMP) will be developed by Contractor mentioning routes to be followed for transportation of construction machinery and materials e.g. cement, steel, gravels, sand, etc. A guideline accessibility map is shown in Chapter 3 of this EIA report. Traffic Management Plan will comprise following contents necessarily:

- Goals and objectives of plan;
- Purpose & Scope;
- Project specific traffic;
- Roles & responsibilities of contractors' environmental personnel;
- Routes to be followed along with necessary maps;
- Transportation timing; and
- Mechanism to address road accidents (if occurs).

716. Guideline for contractor's TMP is attached as **Annex-XIII.**

9.13 CHANCE FIND PROCEDURE

717. The purpose of these guidelines is to address the possibility of archaeological deposits, finds and features becoming exposed during earth removing and ground altering activities associated with the construction and to provide procedures to follow in the event of a chance archaeological find. The chance find procedure of archaeological deposits is attached as **Annex-XVI**.

9.14 CODES OF PRACTICE

718. The Contractor should seek to develop codes of practice for its staff and employees in order to ensure that the intrusion of workers in the Project Area does not result in any social and environmental and social issues between the workers and locals which can harm the Project by causing unnecessary delays.

719. These codes should be based on the principles of environmental protection, occupational health and safety, good engineering practices, respect, integrity and sound ethical values. Each code should include, at minimum, the purpose and objectives, a policy statement from the in charge explaining the importance of this code for the success of the Project, and examples of such conduct. Guidelines for the code of practices are discussed below.

9.14.1 General

720. General code of conduct should be developed for the Project and should include, at minimum, the following practices:

- Rules and guidelines will be given to the workers regarding the use of common resources such as wood, plants, water sources etc. to ensure their sustainable use;
- The code should also include provisions of the solid waste management plan to address solid waste collection and disposal in order to prevent unhygienic conditions and contamination of soil and water;
- The Contractor will make arrangements to avoid accidental risks such as traffic signs board and speed control measures for the safety of locals;
- In construction camps, amenities of life including clean food, water and sanitation facilities must be provided to these camps, and the workers should be provided with guidelines on how to dispose of their waste and maintain a sense of hygiene;
- The training of workers in the construction safety procedures, equipping all construction workers with Personnel Protective Equipment (PPEs) i.e. safety boots, helmets, gloves, ear plugs, and protective masks also and monitoring their proper and sustained usage;
- The Contractor should ensure that the construction labor is trained in safety procedures for all relevant aspects of construction;
- Formal emergency procedures should be developed for construction site in case of an accident. First Aid Kits and other necessary equipment should be kept available at site along with the list of emergency phone numbers at the construction site to be contacted in case of any accident; and
- The safety of the public at all stages of the construction and operation will be ensured by appropriate public education and safety measures such as use of sign boards, barriers and flags and use of proper illumination at night.

9.14.2 Good Engineering Practices

721. Good engineering practices should be developed for the Project and should include, at minimum, the following practices;

- Standard Operating Procedures (SOP) for handling, storage and transportation of oil leakages, chemicals and other toxic materials should be strictly followed;
- Workers must be familiar with the Material Safety Data Sheets (MSDS) of each chemical used at site. MSDS are provided with each chemical drum. Chemicals will be stored as per their MSDS. Utmost care should be taken during the handling of these chemicals;
- Precautions should be taken to prevent spills and all workers should be trained in proper handling, storage and disposal of hazardous or toxic materials; and
- Proper disposal plans of excavated material.

9.14.3 Cultural Norms

722. Cultural Code of Practice should be developed for the Project and should include, at minimum, the following practices:

- Self-respect and sensitivity to insult is an important trait of the locals. The poorest among them has his own sense of dignity and honor and he vehemently refuses to submit to any insult. In fact, every inhabitant considers himself equal if not better than his fellow tribesmen and an insult is, therefore, taken as scurrilous reflection on his character. So the contractor should be careful to avoid any unceremonious interaction with the locals and inform their staff to be humble and polite.
- The Contractor should also take care of the norms of local community and their sensitivity towards local customs and traditions;
- The Contractor should brief the staff about local culture and norms;
- Contractor will strictly warn the staff not to involve in any unethical activities and to obey the local norms and cultural restrictions particularly with reference to women;
- The Contractor will be required to maintain close liaison with the local elders and religious scholars of nearby local community to ensure that any potential conflicts related to common resource utilization for the Project are resolved easily;
- Privacy of women is a major cause of concern for the communities of the Project Area. Due to the Project activities local women may not be able to perform their daily outdoor chores. Women in the Project are participate in other outdoor activities such as livestock rearing, bringing of potable water, collection of fire wood etc. that may be affected by the Project activities;
- The Contractor will have to select the specific timings for the construction activities so as to cause least disturbance to the local population particularly women considering their peak movement hours; and
- The Contractor will warn the staff strictly not to indulge in any un-ethical activities and to obey the local norms and cultural restrictions particularly with reference to women.

723. If privacy of the nearby households is to be affected, the Contractor will inform the house owner in advance to make some alternative arrangements. Similarly, the Contractor will have to take great care that the construction activities should not affect the privacy particularly with reference to women.

9.15 EMP COST

724. The cost for EMP will be part of the contract document with the Contractor. It must be noted that environmental cost will not be a separate entity because all of its components will be addressed in the bidding document under various heads of account. For instance, tree plantation will be a part of landscaping, etc. The annual estimated cost for the implementation of environmental monitoring for both sections of the proposed Project is given in **Table 9.4** along with sampling parameters and frequency during construction and operational phases.

725. The total estimated cost for the environmental and social management, monitoring and auditing during pre-construction, construction and O&M (annual cost and will be updated for next upcoming years accordingly) comes to about **PKR 108.6 Million** excluding land acquisition and compensation cost.

Table 9.3: Environmental Management and Monitoring Cost Estimate

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
A	**PRE- CONSTRUCTION PHASE**						
A-1	**Environmental Monitoring Cost**						
1	Water Resources/ Water Quality	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Once	20,000	06	120,000	One-time monitoring shall be carried out before the mobilization of Contractor.
2	Noise Levels	dBA Leq. as per SEQS 2014	Once	2,000	05	10,000	
3	Ambient Air Monitoring	Monitoring of CO, CO_2, SOx, NO_x, HC and $PM_{2.5}$ PM_{10} by EPA approved Laboratory	Once	30,000	05	150,000	
	Sub-Total (A-1)					**280,000**	
A-2	**Compensation and Resettlement Cost**						
1	Land Acquisition and structure compensation cost	Land cost to the owner, standing crop, structure and tree compensation to	Once based on market value	-----		----	This cost will be incorporated based on the actual loss measured during final LARP prior to construction stage. The total

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
		affectee and tenant,					cost of the LARP will be calculated with all allowances including the actual loss of infrastructure and crops/orchards etc.
	Sub-Total (A-2)					**----**	
A-3	**Tree Plantation Cost**						
1	Tree Plantation Cost	The cost and maintenance of one hectare of afforestation and estimated including cost of layout, digging, planting, carriage and watch and ward and its maintenance for five years	Lump Sum			37,670,000	Refer Sub-Section 9.13.1 The plantation cost is for the restoration of ecosystem and ensure the implementation of national legislations.
Sub-Total (A-3)						**37,670,000**	
Sub-Total A ((A-1)+(A-3))						**37,950,000**	
B	**CONSTRUCTION PHASE**						
B-1	**Environmental Monitoring Cost**						
1	Water Resources/ Water Quality	Discrete grab sampling and laboratory testing	Monthly	20,000	06x12	1,440,000	Monthly monitoring cost for the one-year construction period and will be updated

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
		of water samples by EPA approved Laboratory for monitoring.					each year based on latest rates during construction timeline of the proposed Project.
2	Noise Levels	dBA Leq. as per SEQS 2014	Monthly	2,000	05x12	120,000	
3	Ambient Air Monitoring	Monitoring of CO, CO_2, SOx, NO_x, HC and $PM_{2.5}$ PM_{10} by EPA approved Laboratory	Monthly	30,000	05x12	1,800,000	
Sub-Total (B-1)						**3,360,000**	
B-2	**Environmental and Social Management Cost**						
1	HSE	Environment Personnel will monitor / conduct all HSE related activities e.g. TBTs, PPEs, housekeeping, safety signage, emergency preparedness, etc.	Monthly	300,000		3,600,000	This is the tentative monthly cost for one-year period for one senior and two junior HSE experts along with their monthly logistics.
			Lump sum (3,000,000)			3,000,000	Cost for PPEs, extinguishers, emergency lights, housekeeping equipment, safety signage and barricade, emergency

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
							preparedness kit, first aid kit, etc.
2	Ecological and Biodiversity Monitoring & Management	Monitoring of disturbance of habitats through encroachment, noise and other construction activities.	Monthly	150,000		1,800,000	This is the tentative monthly cost for one-year period for one senior expert along with their monthly logistics.
3	Solid Waste Management	Collection, segregation, transportation, disposal and management of domestic, commercial, construction wastes	Monthly	150,000		1,800,000	This is the tentative monthly cost for one-year period for one senior expert along with their monthly logistics.
			Lump sum (1,000,000)			1,000,000	Cost for Collection, segregation, transportation, disposal and management of domestic, commercial, construction wastes
4	Social Welfare Cost	Based on the regular consultations with stakeholders including affectees and nearby community, through basic	Lump sum (5,000,000)			5,000,000	Different social welfare Projects i.e. easy loans for affectees, rehabilitation of schools, roads, tracks, irrigation channels etc.

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
		need assessment by the contractor and verified by PMU/NTDC coordinating the district social welfare department.					
5	Training Cost	Literature preparation, printed material such as posters & pamphlets trainer(s), and venue, etc.	Monthly	100,000		1,200,000	This is the tentative monthly cost for one-year period for one trainer along with logistics at site.
6	Third Party Environmental Consultant	Auditor's checklists & proformas	Bi-annual	400,000		800,000	This is the tentative biannual cost for one-year period for at least two auditors along with logistics, travels and accommodation charges.
7	Communicable Diseases	Tests should be performed by approved laboratory	Biannually	600,000		1,200,000	This is the tentative cost for one-year period for medical tests of kitchen staff at each camp site.
Sub-Total (B-2)						**19,400,000**	

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
Sub-Total B ((B-1)+(B-2))						**22,760,000**	**Tentative for one year. The cost shall be updated based on the current market prices during construction phase.**
Sub-Total B ((B-1)+(B-2))						**56,900,000**	**Tentative for 30 months (2.5 years) Project construction period. The cost shall be updated based on the current market prices during construction phase.**
C	**OPERATION & MAINTENANCE PHASE (One Year Cost)**						
C-1	**Environmental Monitoring Cost**						
1	Water Resources/ Water Quality	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Biannually	20,000	03x02	120,000	Biannually monitoring cost for the one year O&M Phase and will be reproduced for next years of O&M based on updated rates.
2	Noise Levels	dBA Leq. as per SEQS 2014	Biannually	2,000	02x02	8,000	
3	Ambient Air Monitoring	Monitoring of CO, CO_2, SOx,	Biannually	30,000	02x02	120,000	

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
		NO_x, HC and $PM_{2.5}$ PM_{10} by EPA approved Laboratory					
Sub-Total (C-1)						**248,000**	
C-2	**Environmental and Social Management Cost**						
1	HSE Activities	Concessionaire	Monthly	300,000		3,600,000	This is the tentative monthly cost for one-year period for one senior HSE staff along with his site visit cost and logistics arrangements.
	Sub-Total (C-2)					**3,600,000**	
	Sub-Total C ((C-1)+(C-2))					**3,848,000**	**Tentative for one (01) year Project O&M phase. The cost shall be reproduced for next years of O&M Phase and updated based on the current market prices during O&M phase.**
	Grand Total (A+B+C)					**98,698,000**	
	Contingency Charges	10% of Grand Total				**9,869,899**	
	Grand Total with Contingencies					**108,567,800**	**Excluding Land Acquisition and Compensation Cost**

10 CONCLUSION AND RECOMMENDATIONS

10.1 CONCLUSION

726. This report has been prepared in accordance with the requirements of the Sindh Environmental Protection Act, 2014, SEPA (Environmental Assessment) Regulations, 2021 for review of IEE and EIA; Pakistan EIA procedures; and sectoral guidelines for environmental reports: Major Roads. Considering the prevailing conditions of Project area and based on the SEPA (Environmental Assessment) Regulations, 2021, the proposed Project has been classified as "Category A" for which EIA is required as the Project will affect crops, infrastructure and settlements including physical displacement. Thus, to fulfil local (SEPA) legal requirements, an EIA Study was conducted for the proposed MEX.

727. The main objective of the proposed Project is to establish a direct southern transport link between the Karachi Port including the allied facilities of SAPT, PICT, KICT and the Keamari Oil Terminal and the Karachi – Hyderabad Motorway (M-9). This Project will also help to reduce traffic congestion, delays, economic losses and environmental pollution on the city road network by exclusion of the external traffic i.e., traffic having both its origins and destinations outside the city or on its periphery, from the present routes to the proposed Malir Expressway.

728. Two type of alternatives have been considered during the EIA study which include No Project Option (NPO), Comparison of Widening of Existing Roads to Access the Required Destinations and Construction of New Malir Expressway. Based on the alternative analysis, the proposed Malir expressway will cause least environmental and social damages due to lesser travel distance and time and limited land acquisition and resettlement issues. This expressway will also provide a natural bund (due to embankments) to the seasonal urban floods in heavy monsoon rains. Due to these reasons, this Project is much environmentally and socially feasible and economically viable.

729. During the field surveys, significant efforts were made to identify the main physical, ecological, social, cultural, and environmental issues related to the construction and operation of the proposed MEX. Various stakeholders including government departments and agencies were also contacted for obtaining salient information in this regard along with that from area residents. RoW of the proposed expressway from the center line is 50 m on either side of the centerline. Following is the list of main issues and concerns:

- Land acquisition, relocation and resettlement;
- Cutting of trees/bushes falling within the proposed ROW;
- Disturbance to infrastructure and public utilities;
- Disturbance to the public movement during construction;
- Reduction in the daily routine activities of local residents during construction;

- Noise and air pollution due to the working of construction machinery during construction and traffic during O&M phases of the Project;
- Air Modelling by using CALRoads 6.5 was carried out to assess the O&M phase impact which is discussed in Chapter 7 in detail;
- Solid waste and wastewater generation during construction;
- Oil spillages from construction machinery, resulting in soil and groundwater contamination;
- Surface water bodies contamination due to soil erosion and construction activities; and
- Occupational and community health and safety issues.

730. After the construction of the proposed MEX, people living in the Project Area and the road users / travelers will get the following benefits:

- Less time will be required for travelling and reaching the destination;
- Accelerate the economic activity by providing smooth access to nationwide markets;
- During the construction phase, local labor will be accommodated in the construction activities leading to poverty alleviation;
- It will provide sustainable delivery of a productive and efficient national highway system contributing to decreasing transportation cost;
- Traffic load on existing main roads of Karachi city will get reduced;
- It will also act as a vertebral part of National Trade Corridor and major linking limb between Karachi and upcountry;

731. Project is socio-economically viable and environment friendly if EMP is implemented in true letter and spirit. Results of the EIA Study have shown that the impacts of the Project activity on the physical and biological environment will be negligible. However, there will be significant impacts on the social environment. These impacts could be reduced by proper and judicious compensation and relocation payment to the affected, which will need to be developed in the Land Acquisition and Resettlement Plan which will be developed after the Section IV of Land Acquisition Act has been finalized by the Revenue Department. Well planned meticulous design of the facility and implementation of an appropriate tree plantation plan as suggested in EMP will also enhance the environmental sustainability of the proposed MEX Project. The plantation will enhance the aesthetics; improve the landscape as well as the environmental conditions along the Project Area. In fact, in times of diminishing economic and natural resources, using sustainable approaches in transportation infrastructure will help us to enhance quality of life and serve the transportation needs of the present leaving provision for future generations to meet their needs.

732. An Environmental Management Plan (EMP) for both the phases (construction and operation) has been developed as part of the report which provides a detailed mitigation matrix that covers impacts, mitigation measures roles and responsibilities and timings to avoid, minimize or mitigate the adverse impacts of the Project.

733. On assessment of impacts, the Malir Expressway project can become a sustainable part of the fabric of Karachi, if proposed mitigation measures are adopted and followed in letter and spirit.

Annex I – Topography

NOTES:-

1. ALL DIMENSIONS ARE IN METER UNITS.
2. ALL COORDINATES ARE WITH RESPECT TO WGS84 DATUM AND UTM PROJECTION ZONE 42
   OBSERVED USING DUAL FREQUENCY GPS AT DATUM STATIONS BM1 & BM2.
   VALUES OF THESE DATUM STATIONS ARE AS FOLLOWS:

   WGS84 SPHERICAL COORDINATES
   BM1 24°49'23.51997"N 67°05'12.72817"E
   BM2 24°49'34.42707"N 67°05'11.64646"E

   UTM 42 ZONE GRID COORDINATES
   BM1 E=306647.733m N=2746726.706m
   BM2 E=306622.065m N=2747062.726m

3. VERTICAL DATUM TRANSFERRED FROM MONUMENT S-50 FIXED ON ROOF TOP OF MARINA CLUB DINNING HALL
   THE VALUES OF MONUMENT ARE:
   LATITUDE=24°47'46.979"N LONGITUDE=67°04'48.976"E
   HEIGHT WITH REFERENCE TO PQA BUNDAL DATUM =11.575m
4. DIFFERENCE OF SOP AND PQ ZERO ELEVATION DATUMS
   THE DIFFERENCE BETWEEN PORT QASIM (PQ) PIPRI DATUM AND SOP DATUM IS 1.821m WITH THE PQ DATUM SET LOWER. THE SOP DATUM IS BASED ON MEAN SEA LEVEL WHILE THE PQ DATUM IS BASED ON A CHART DATUM ESTABLISHED AT PIPRI.

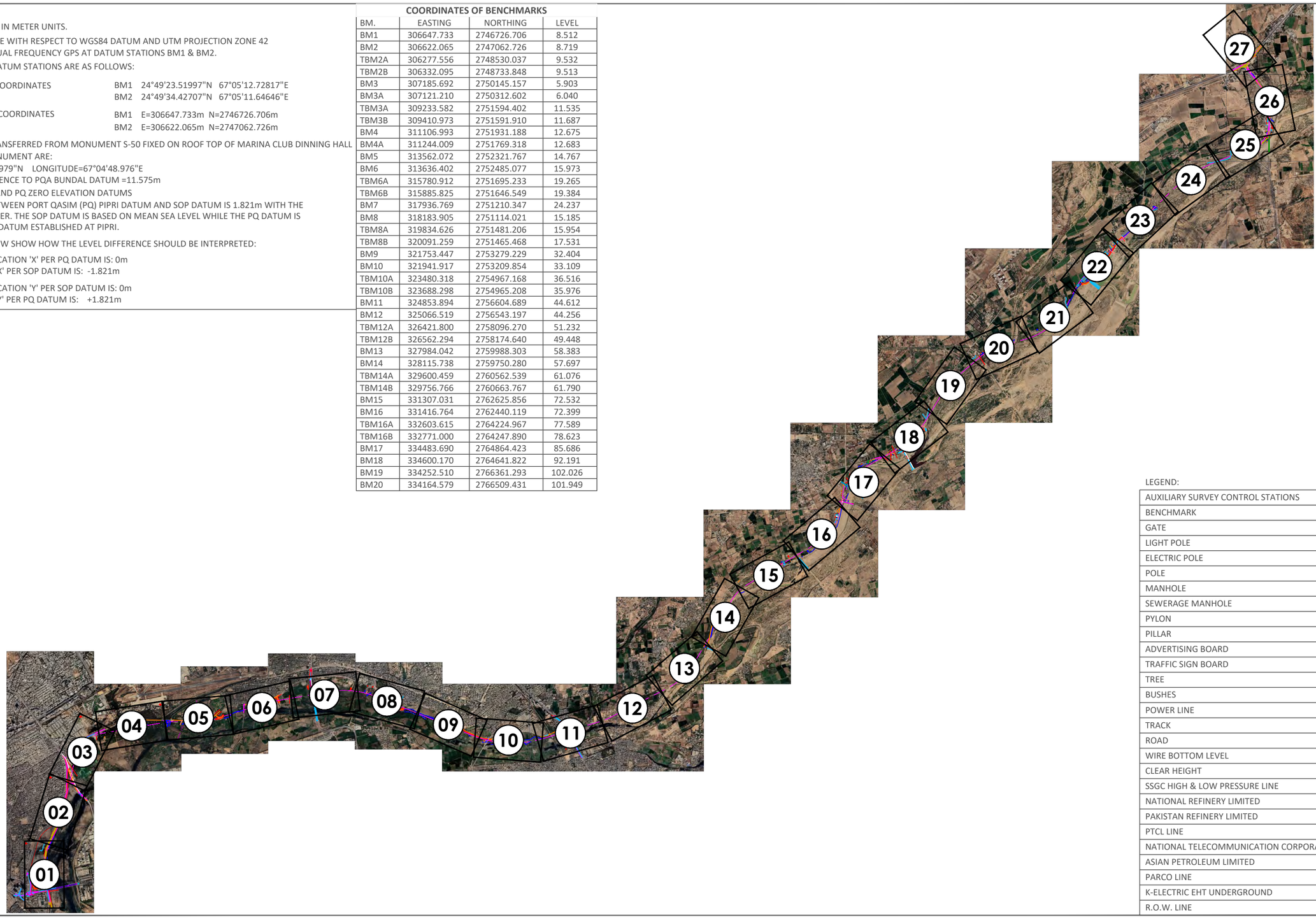
   THE EXAMPLES BELOW SHOW HOW THE LEVEL DIFFERENCE SHOULD BE INTERPRETED:

   IF ELEVATION AT LOCATION 'X' PER PQ DATUM IS: 0m
   THE ELEVATION AT 'X' PER SOP DATUM IS: -1.821m

   IF ELEVATION AT LOCATION 'Y' PER SOP DATUM IS: 0m
   THE ELEVATION AT 'Y' PER PQ DATUM IS: +1.821m

COORDINATES OF BENCHMARKS

BM.	EASTING	NORTHING	LEVEL
BM1	306647.733	2746726.706	8.512
BM2	306622.065	2747062.726	8.719
TBM2A	306277.556	2748530.037	9.532
TBM2B	306332.095	2748733.848	9.513
BM3	307185.692	2750145.157	5.903
BM3A	307121.210	2750312.602	6.040
TBM3A	309233.582	2751594.402	11.535
TBM3B	309410.973	2751591.910	11.687
BM4	311106.993	2751931.188	12.675
BM4A	311244.009	2751769.318	12.683
BM5	313562.072	2752321.767	14.767
BM6	313636.402	2752485.077	15.973
TBM6A	315780.912	2751695.233	19.265
TBM6B	315885.825	2751646.549	19.384
BM7	317936.769	2751210.347	24.237
BM8	318183.905	2751114.021	15.185
TBM8A	319834.626	2751481.206	15.954
TBM8B	320091.259	2751465.468	17.531
BM9	321753.447	2753279.229	32.404
BM10	321941.917	2753209.854	33.109
TBM10A	323480.318	2754967.168	36.516
TBM10B	323688.298	2754965.208	35.976
BM11	324853.894	2756604.689	44.612
BM12	325066.519	2756543.197	44.256
TBM12A	326421.800	2758096.270	51.232
TBM12B	326562.294	2758174.640	49.448
BM13	327984.042	2759988.303	58.383
BM14	328115.738	2759750.280	57.697
TBM14A	329600.459	2760562.539	61.076
TBM14B	329756.766	2760663.767	61.790
BM15	331307.031	2762625.856	72.532
BM16	331416.764	2762440.119	72.399
TBM16A	332603.615	2764224.967	77.589
TBM16B	332771.000	2764247.890	78.623
BM17	334483.690	2764864.423	85.686
BM18	334600.170	2764641.822	92.191
BM19	334252.510	2766361.293	102.026
BM20	334164.579	2766509.431	101.949



LEGEND:

AUXILIARY SURVEY CONTROL STATIONS	△
BENCHMARK	◔
GATE	⋈
LIGHT POLE	
ELECTRIC POLE	Ⓔ
POLE	○
MANHOLE	□
SEWERAGE MANHOLE	Ⓢ
PYLON	⊠
PILLAR	⊞
ADVERTISING BOARD	
TRAFFIC SIGN BOARD	
TREE	
BUSHES	
POWER LINE	
TRACK	
ROAD	
WIRE BOTTOM LEVEL	WBL=
CLEAR HEIGHT	CLR HT=
SSGC HIGH & LOW PRESSURE LINE	
NATIONAL REFINERY LIMITED	
PAKISTAN REFINERY LIMITED	
PTCL LINE	
NATIONAL TELECOMMUNICATION CORPORATION	
ASIAN PETROLEUM LIMITED	
PARCO LINE	
K-ELECTRIC EHT UNDERGROUND	
R.O.W. LINE	

CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC

CLIENT:- ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 01 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 01 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

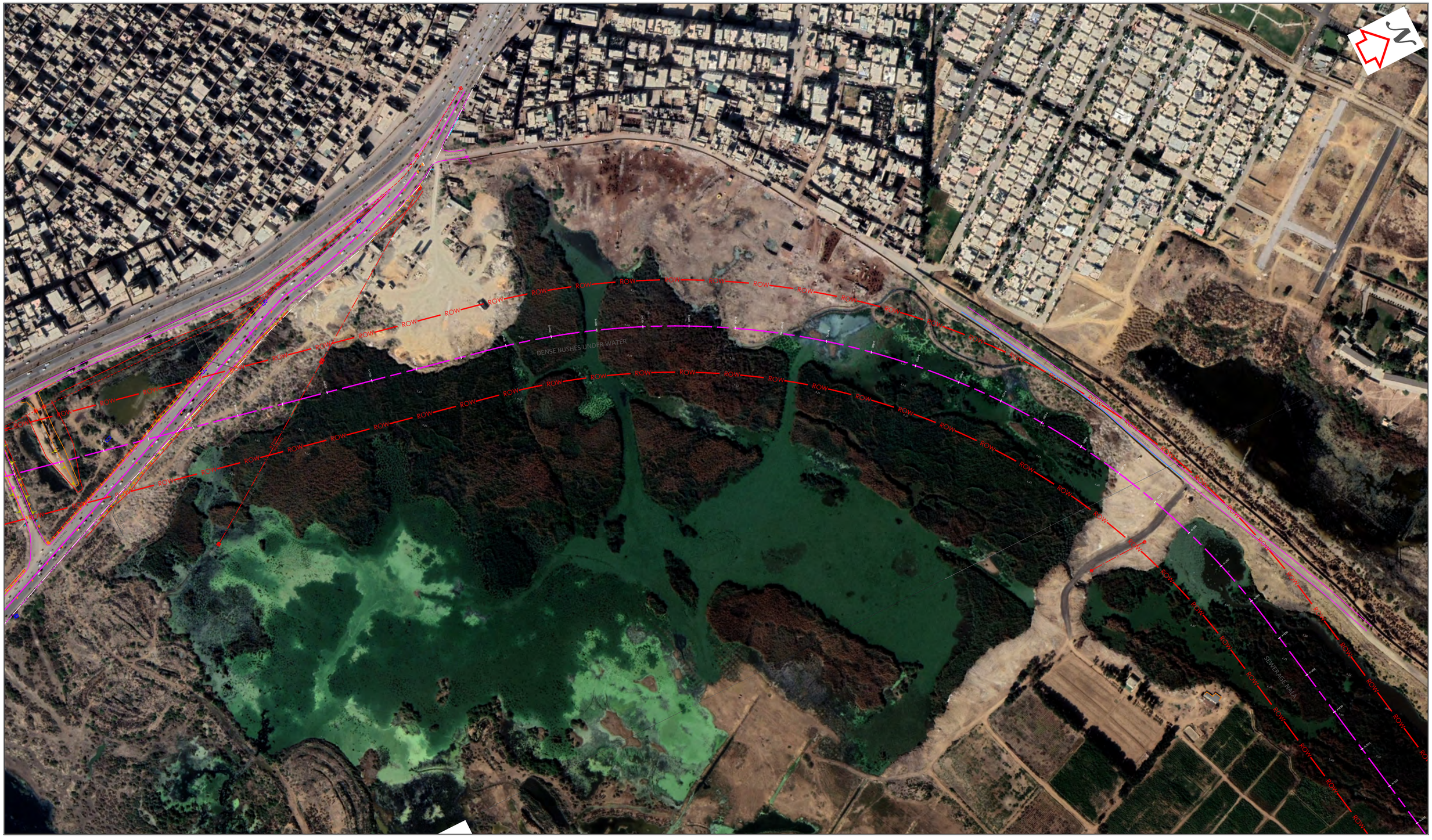
Drawing No. ME-01



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 02 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No. ME-01



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 03 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

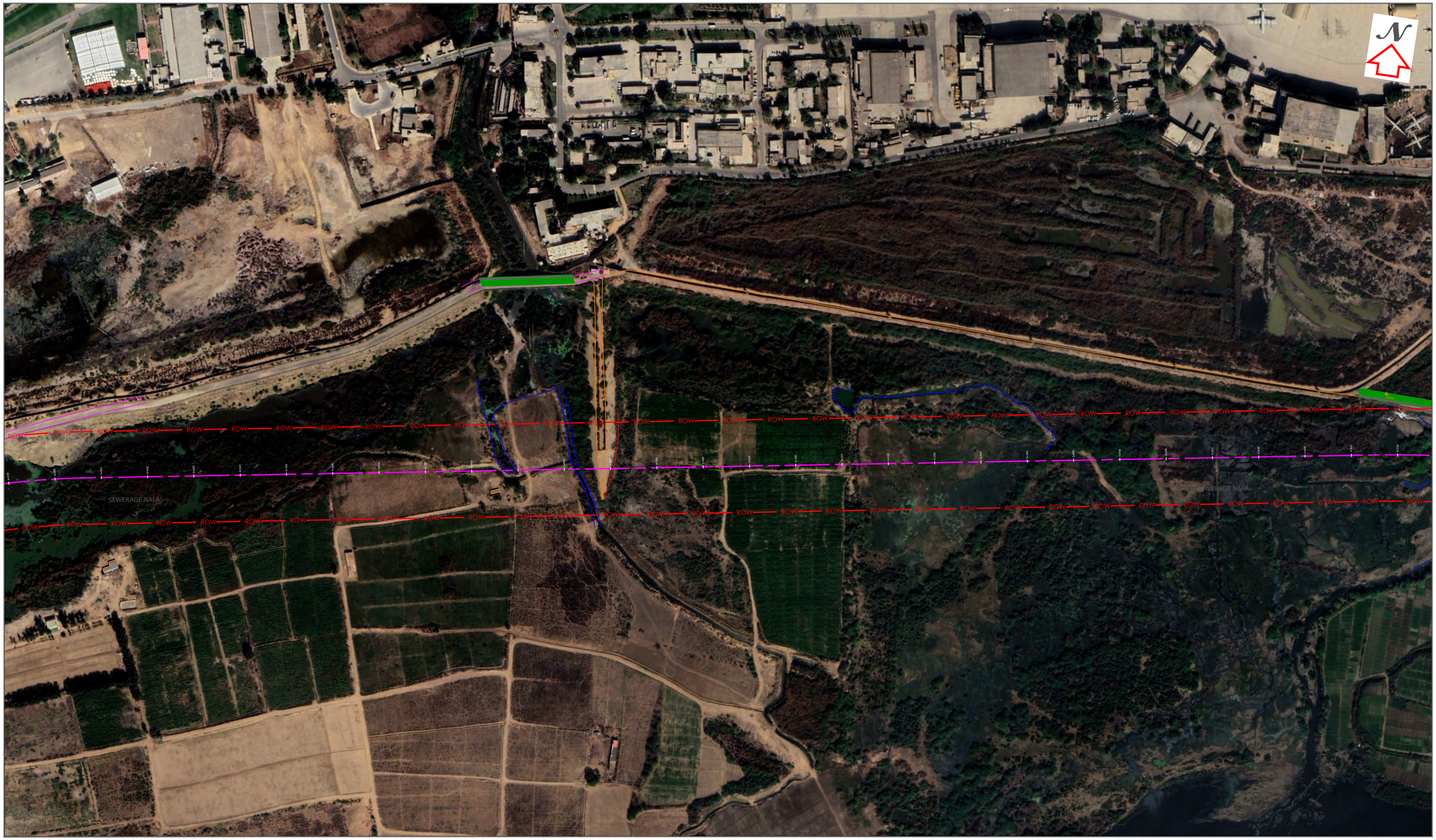
PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 04 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No. ME-01



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 05 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 06 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 07 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

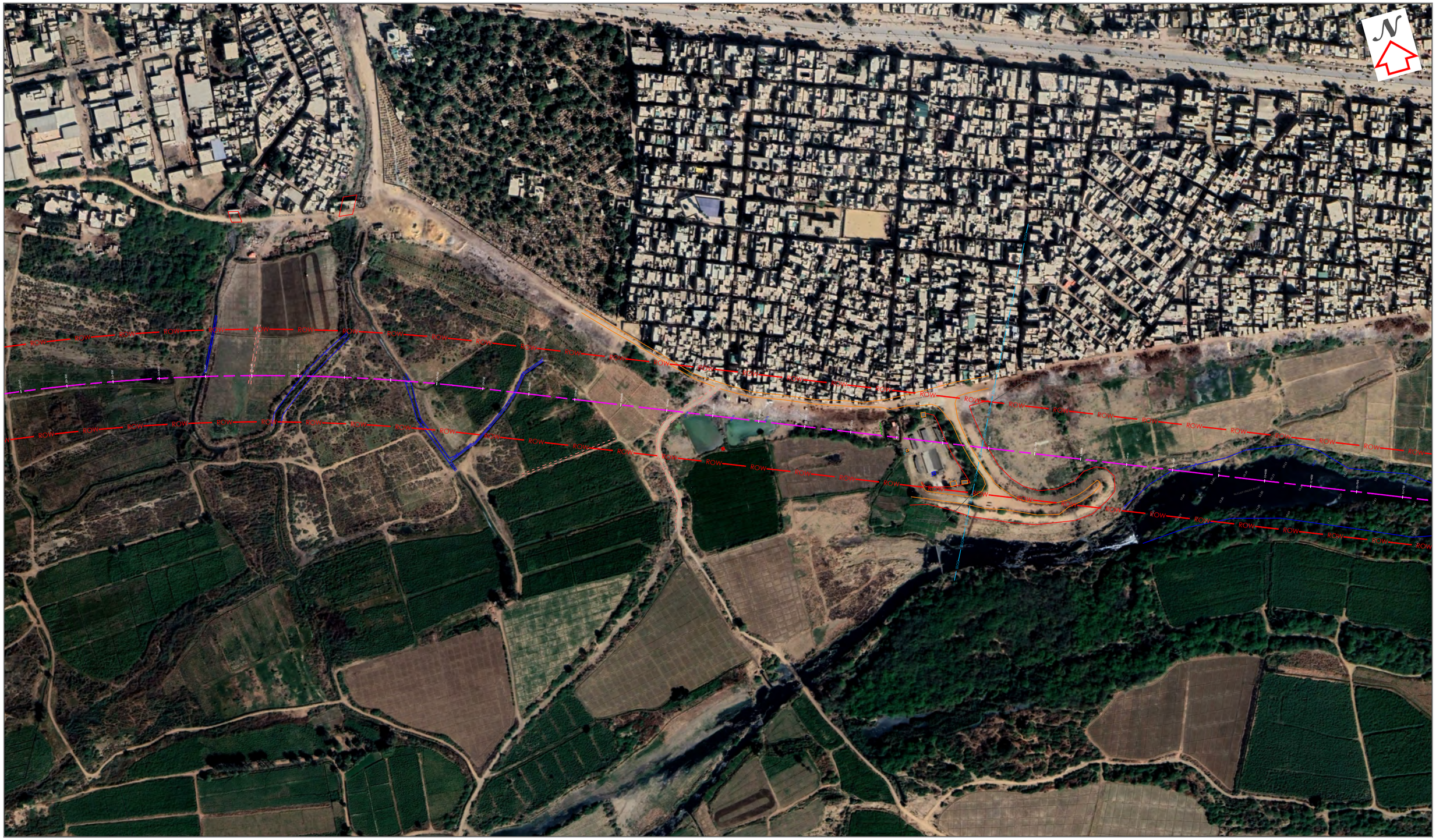
PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 08 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

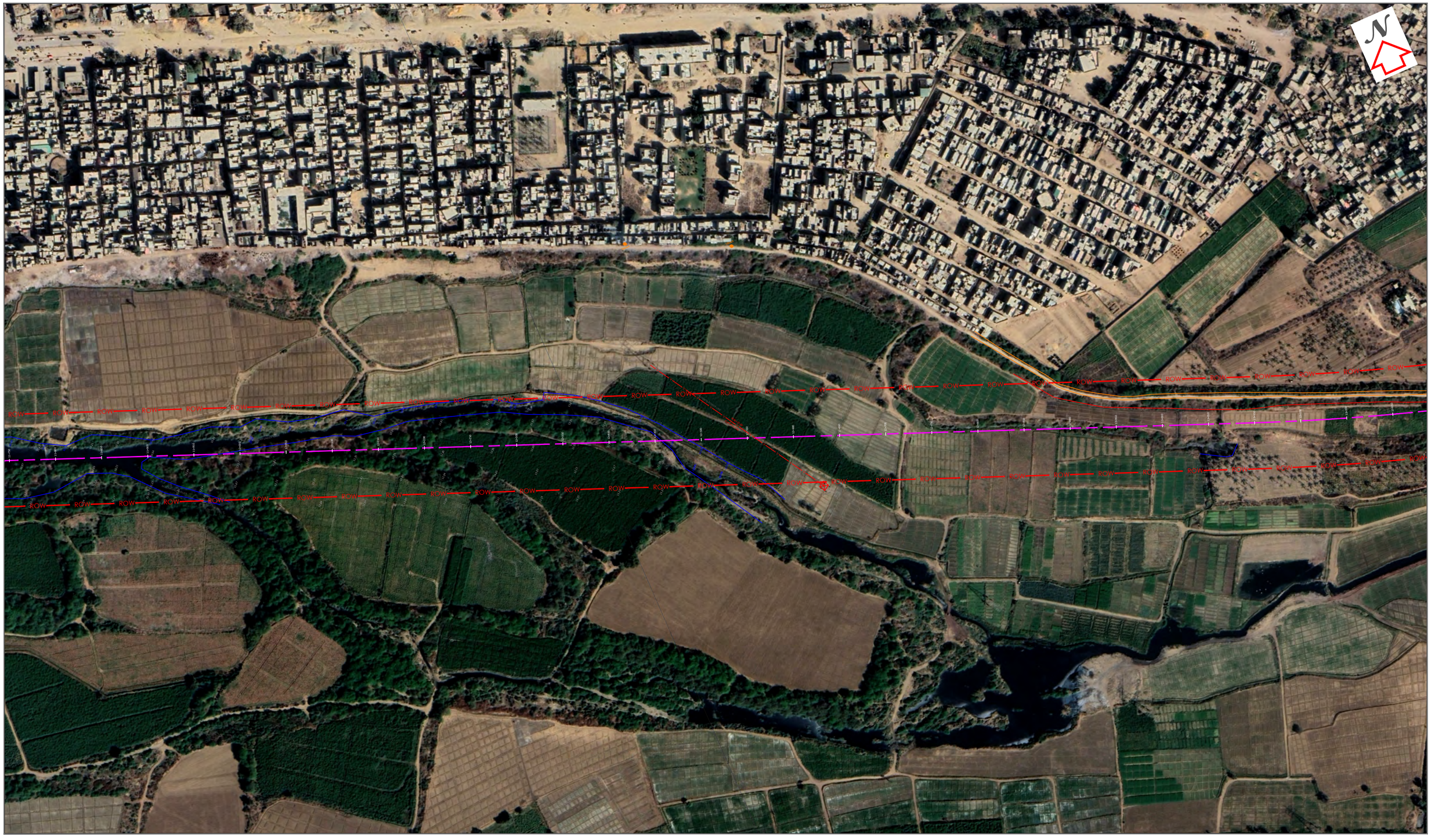
PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 09 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

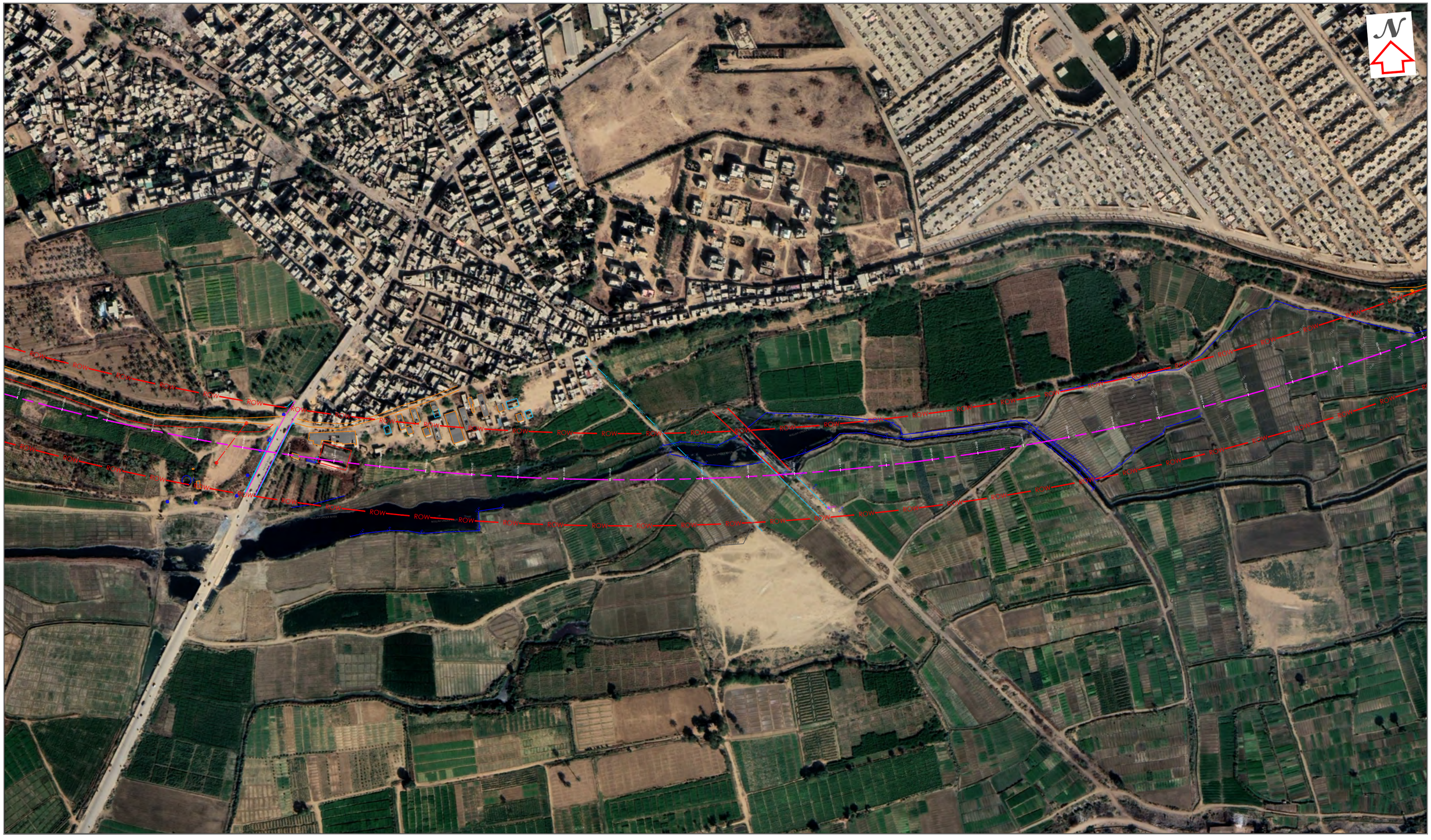
PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 10 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

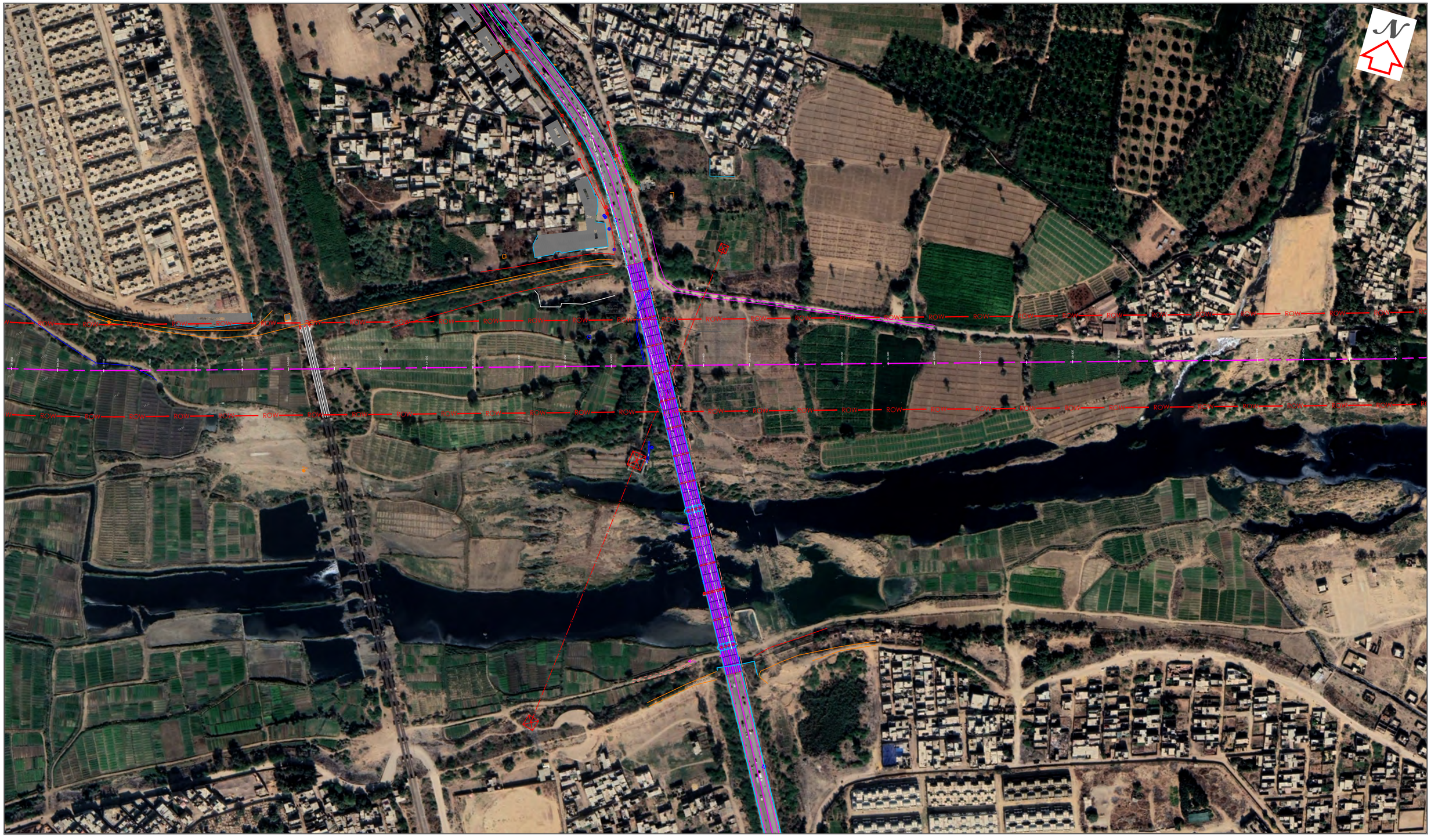
PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 11 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

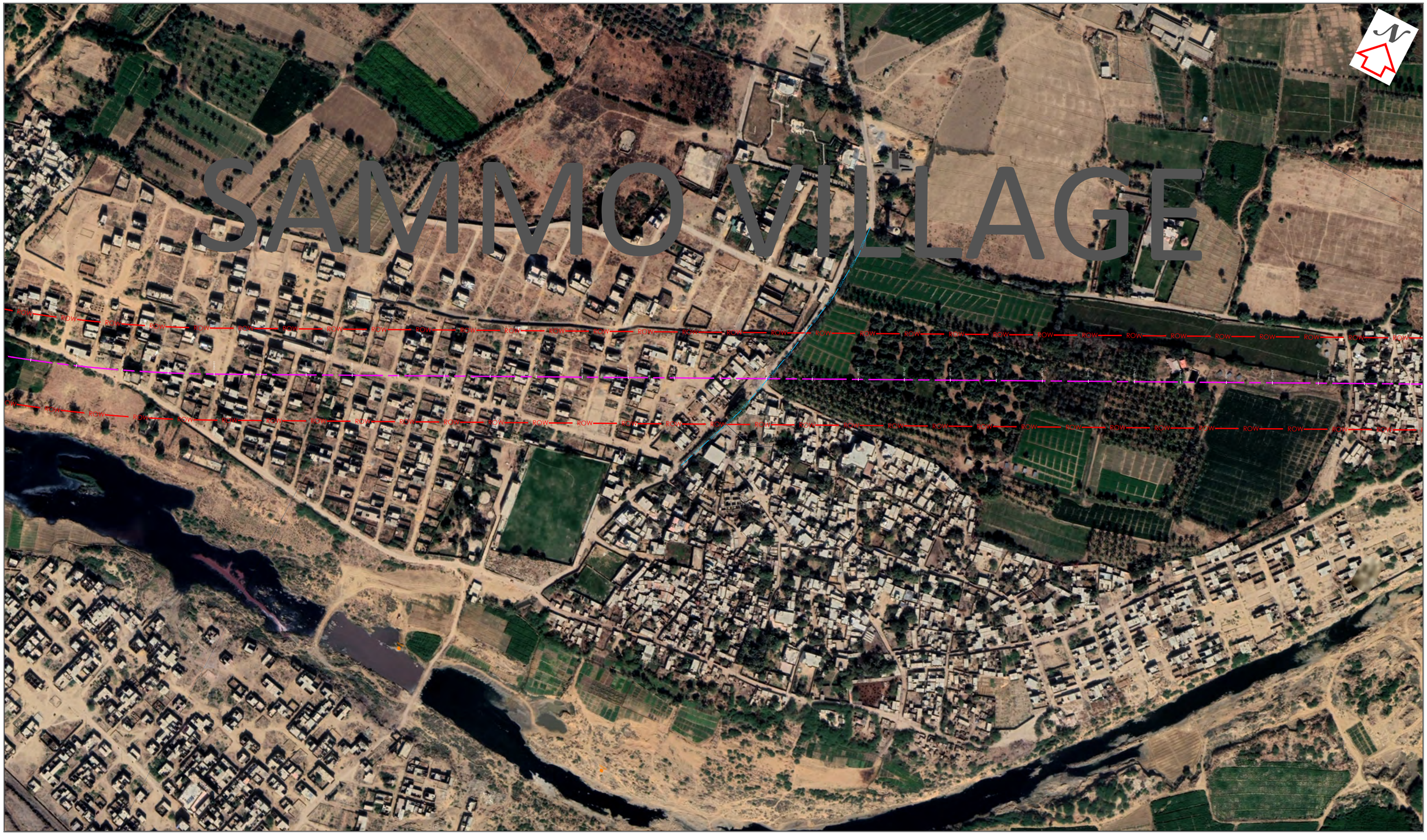
PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

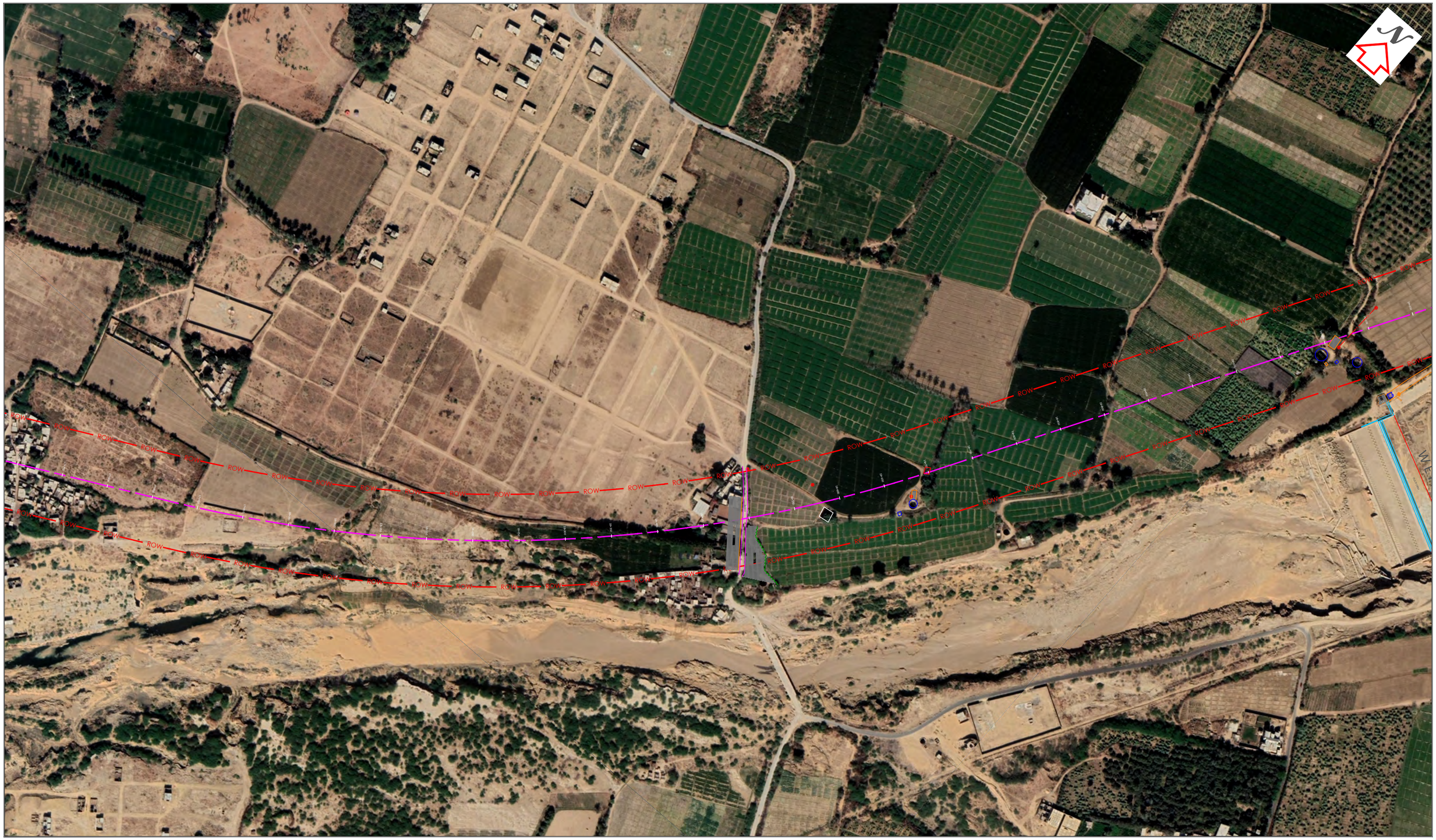
NOTES:-



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 12 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No. ME-01



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 13 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 14 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

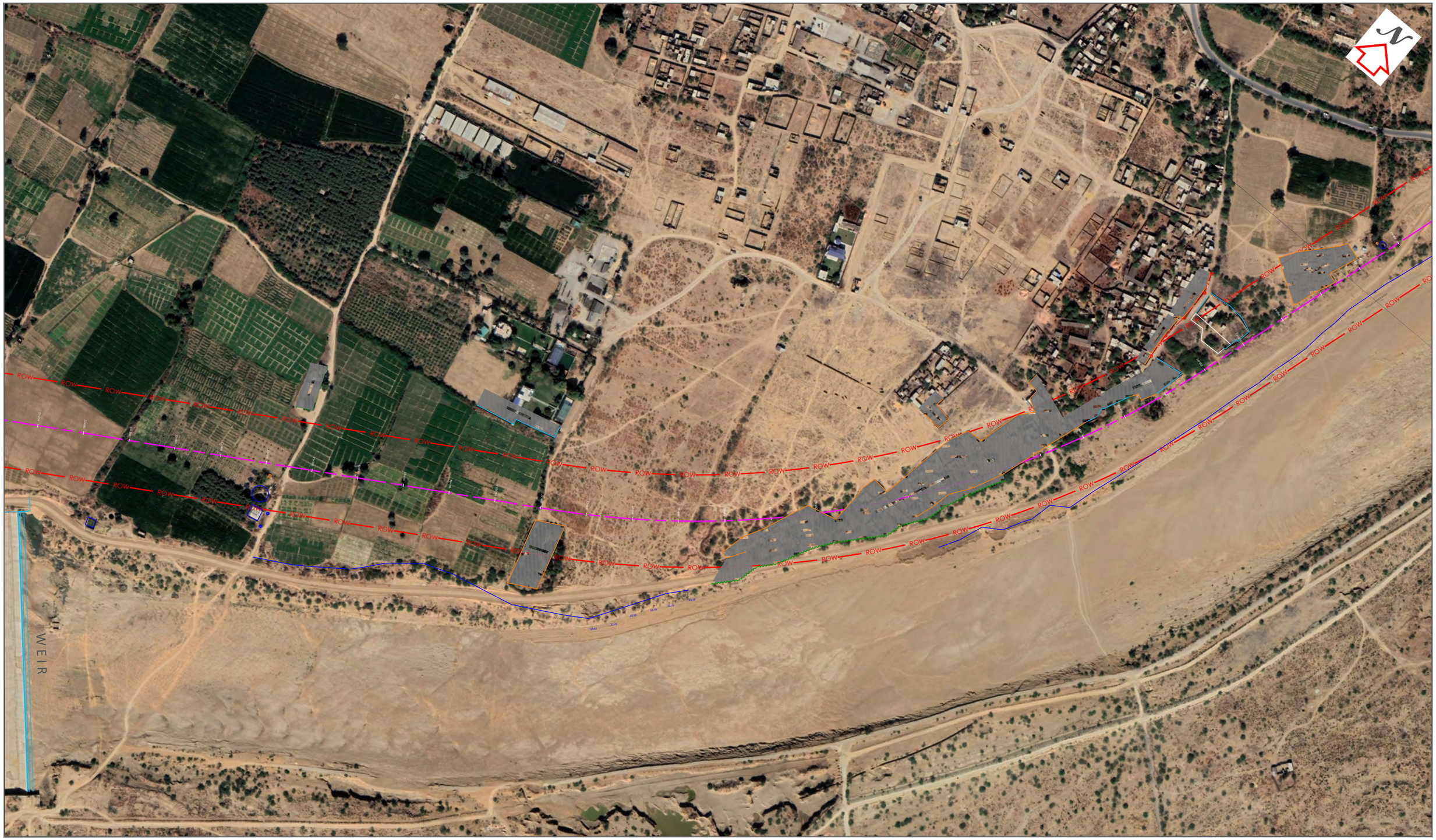
Drawing No. ME-01



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 15 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

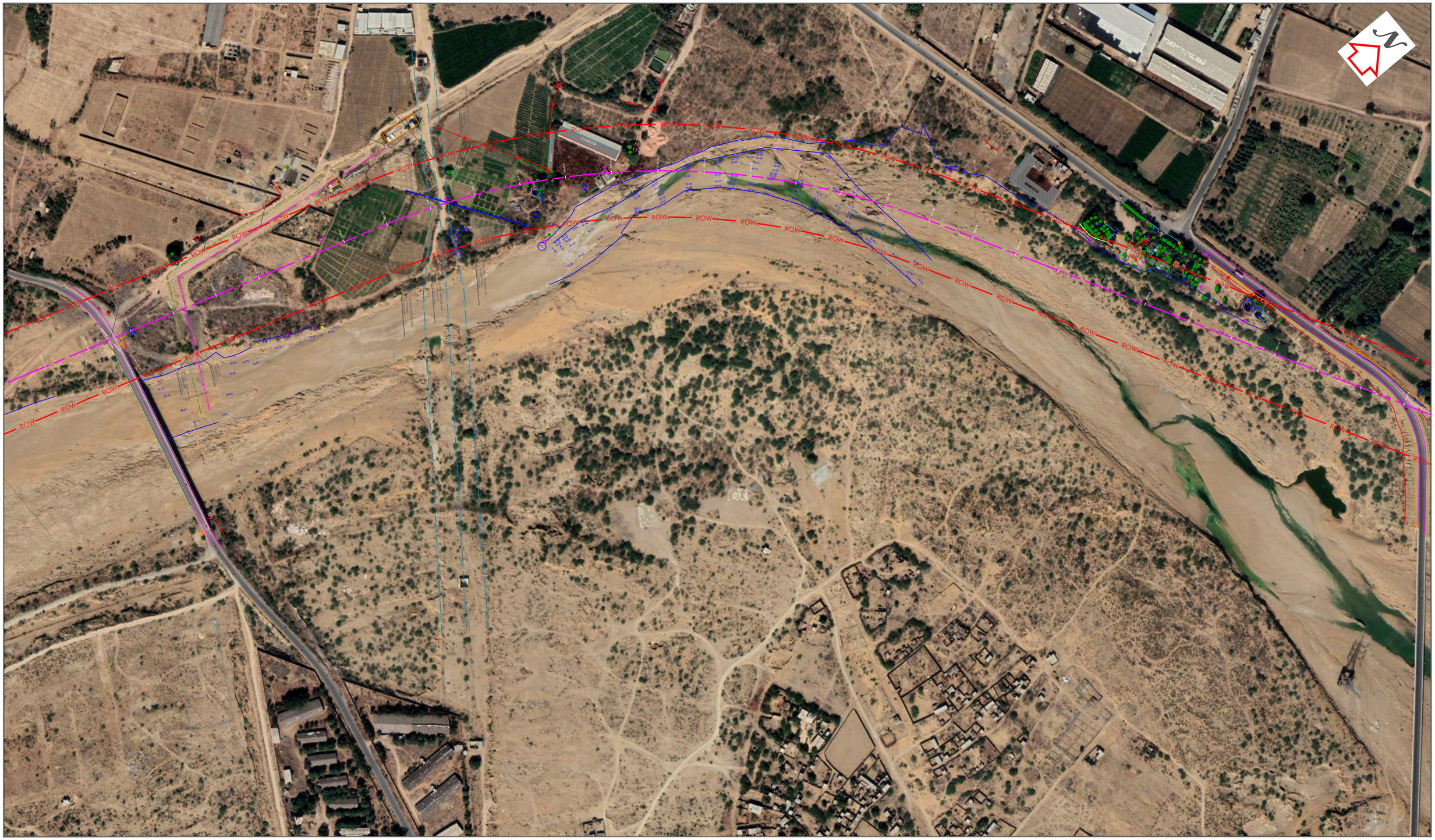
Drawing No. ME-01



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 16 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No. ME-01



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 17 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 18 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

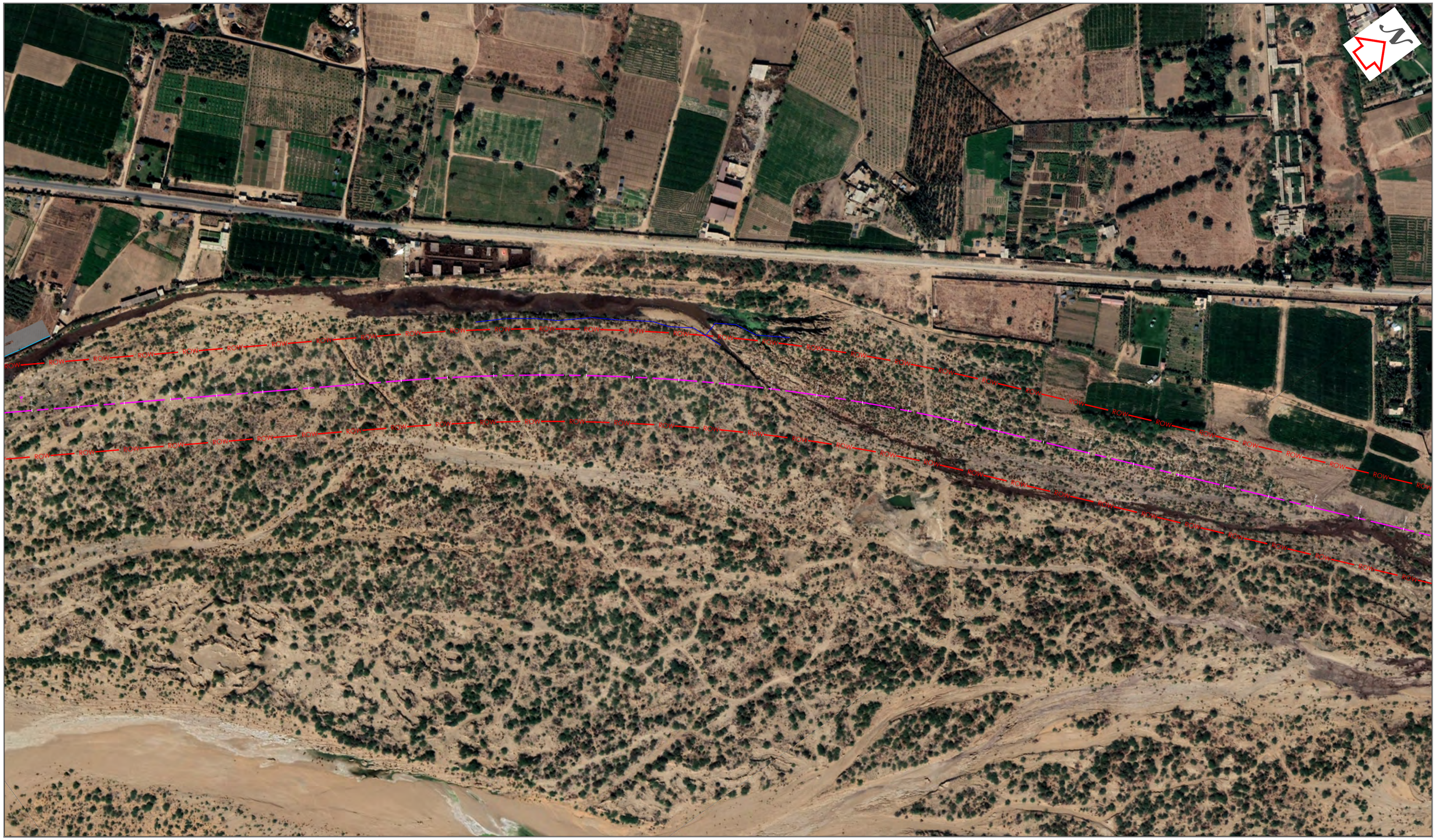
PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

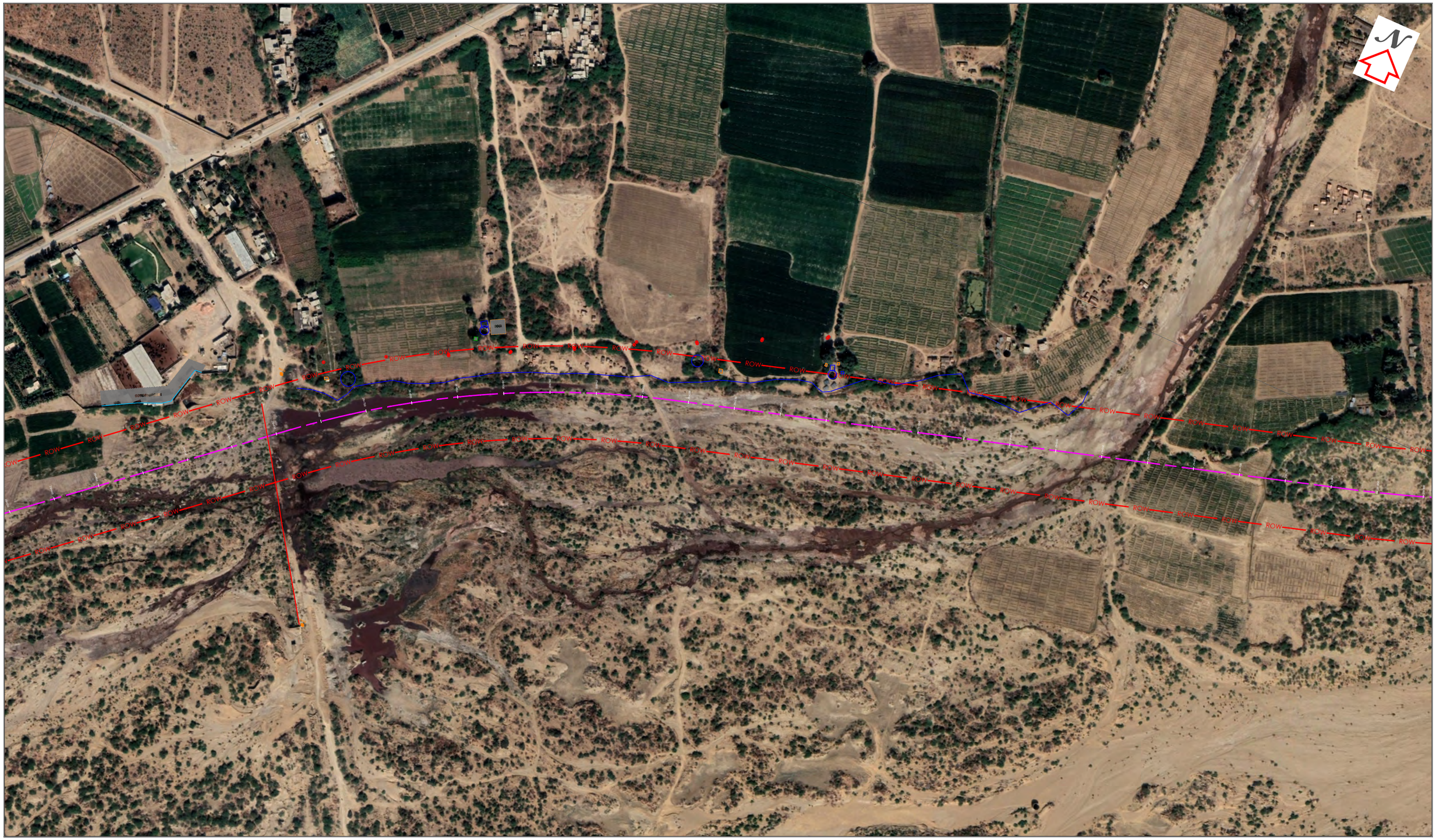
NOTES:-



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 19 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No. ME-01



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 20 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No. ME-01


ROW
ROW
ROW



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 22 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

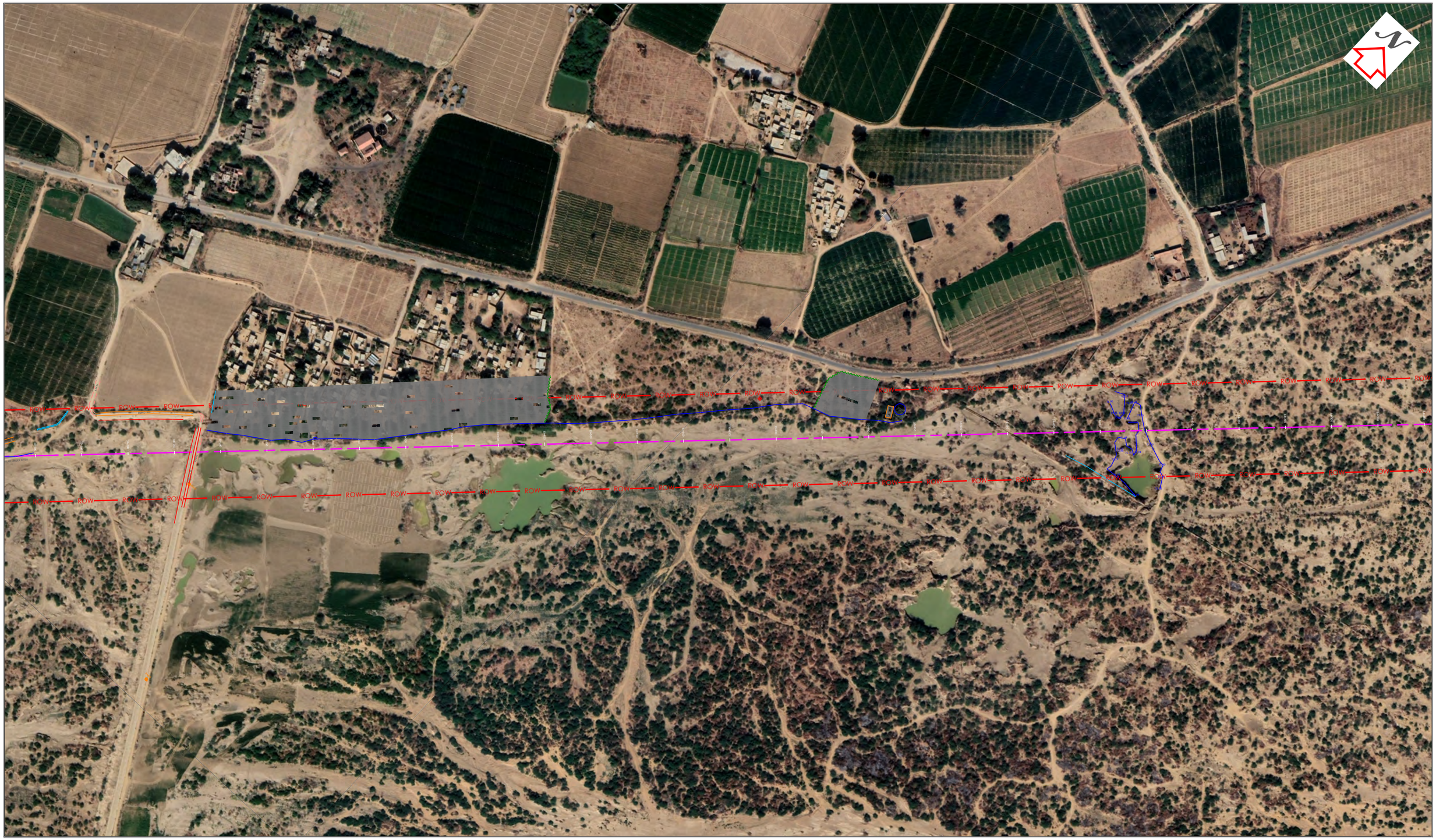
PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 23 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 24 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

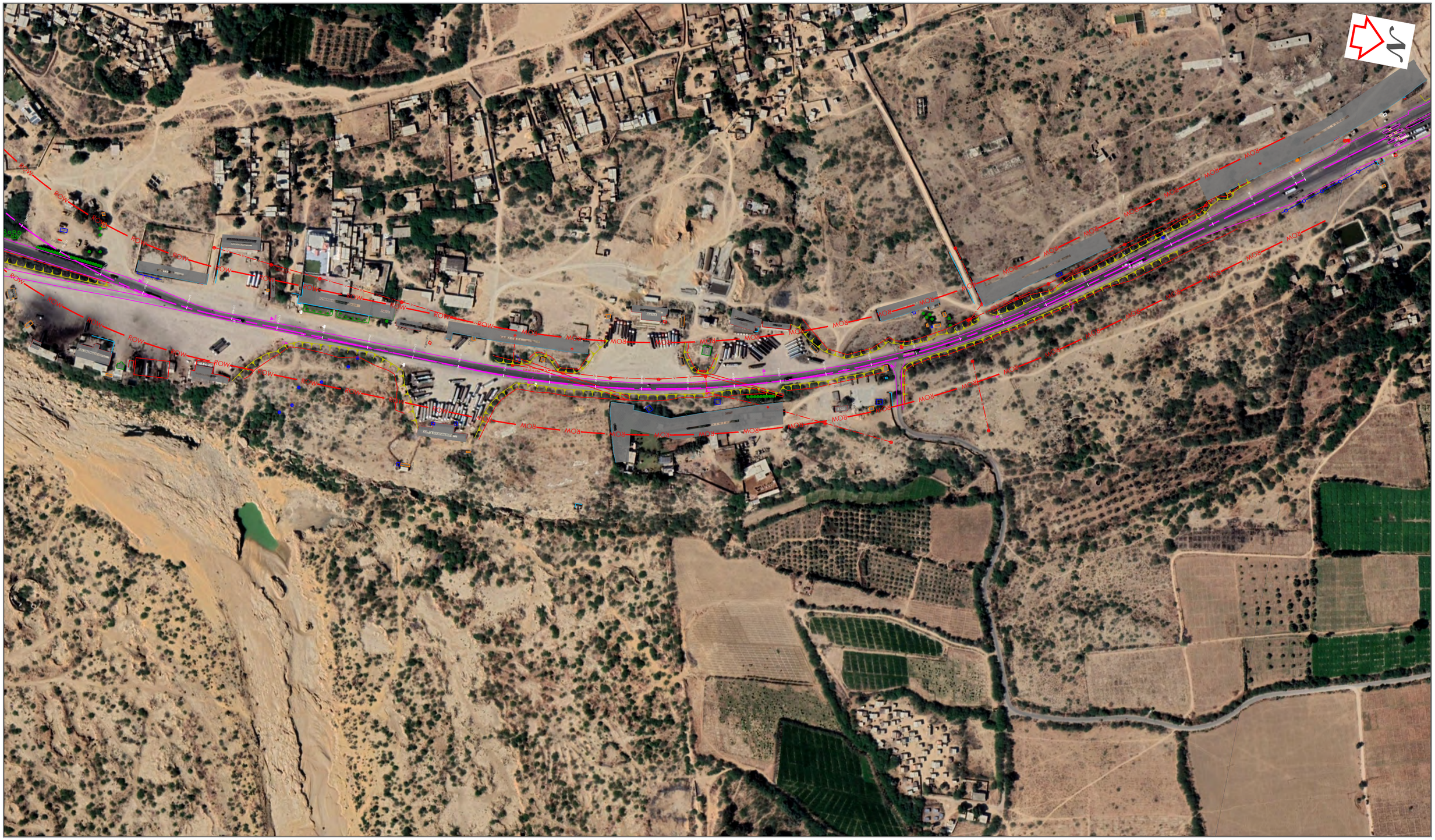
NOTES:-



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 25 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No. ME-01



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 26 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No. ME-01



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 27 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	SEPTEMBER, 2021

Drawing No.

ME-01

PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-

Annex II – Geometric Design

GENERAL NOTES

1. ALL DIMENSION AND DISTANCE SHOWN ON DRAWINGS PERTAINING TO TYPICAL DETAILS AND ROAD PLANS AND PROFILE ARE IN METER UNLESS OTHERWISE MENTIONED.

2. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY LOCATION OF ALL UTILITIES, WATER COURSE ETC. AS SHOWN ON THE PLANS OR AS OTHERWISE ENCOUNTERED DURING CONSTRUCTION.

3. THE ENGINEER MAY VERY THE CUT SLOPE, FOUNDATION AND OTHER FEATURE OF DESIGN AS DEEMED NECESSARY TO CONFIRM TO THE VARYING SITE CONDITION DURING THE EXECUTION OF WORK AS MAY BE DISCOVERED FROM THE STAKE OUT SURVEY. ALL SUCH CHANGES SHALL BE GOVERNED BY THE RELEVANT CONTRACT CONDITIONS.

4. THE UTILITIES LINES SHOULD BE RELOCATED ACCORDING TO THE INSTRUCTION OF ENGINEER AND TO THE SATISFACTION OF CONCERNED AUTHORITIES.

5. THE GROUND HEIGHT, STRUCTURE LOCATIONS, ELEVATION, SKEW ANGLE AND GRADES SHALL BE CHECKED DURING STAKE OUT SURVEY BEFORE EXECUTION OF THE WORKS SUFFICENTLY IN ADVANCE, ADJUSTMENT IN THE RELEVANT DRAWING IF ANY SHALL BE APPROVED BY THE ENGINEER BEFORE EXECUTION.

NOTES

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES
(DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
1-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

GENERAL NOTES

DESIGN BY: AYESHA SHABBIR	SHEET NO:
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/GEN/01

LEGENDS IN PLAN

REPRESENTATIVE LEGEND	DESCRIPTION
B.M T.P	BENCH MARK / TRAVERSE POINT
	BUILT UP AREA
	BUSHES
	DEPRESSION / DITCH / POND
	DESIGNED CENTER LINE
	DYKE
	EXISTING BRIDGE
K.TRACK	EXISTING KATCHA TRACK
	EXISTING METALLED ROAD
	EXISTING BOX CULVERT
	FENCE
TREE	GARDEN / TREES / ORCHARD
	GRAVES / GRAVE YARD
E. LINE 11 KV	H.T / L.T POWER TRANSMISSION LINE
	GRID LINE
PI STA= I= Da= Dc= T= R= L= X= Y= E=	HORIZONTAL CURVE DATA
	HUT / MUD HOUSE
	BORE HOLE
	LAND ACQUISITION
	MOSQUE
	MUD WALL
N E S W	NORTH ARROW

REPRESENTATIVE LEGEND	DESCRIPTION
	NATURAL SURFACE LEVEL
	BOX CULVERT
	PIPE CULVERT
P.I #	POINT OF INTERSECTION
	PROPOSED RIGHT OF WAY LINE
	RELOCATED PROPOSED WATER COURSE
	RIVER / NULLAH
SIGN NO. PROVIDED BY NTRC 101	ROAD SIGN
	RAILWAY CROSSING GATE
	ANNOTATED CONTOURS
	STONE PITCHING (GROUTED)
	STONE PITCHING (DRY)
E. LINE 500 KV V V V V V	TRANSMISSION LINE 500KV
TP #	TRAVERSE STATION
	TUBE WELL / WELL
	PIPELINE

LEGENDS IN PROFILE

	DESCRIPTION
	BOX CULVERT
	BRIDGE
	FINISHED GRADE LINE
	EXISTING ROAD LEVEL (PROFILE)
	PIPE CULVERT
HIGH PT STA: 7+92.29 HIGH PT ELEV: 849.26 PVI STA:0+866.75 PVI ELEV:854.13 K:58.51 LVC:500.00	VERTICAL CURVE DATA

ABBREVIATIONS & DESCRIPTION

A	AREA
ALIG.	ALIGNMENT
B	BREADTH
BC	REINFORCED CONCRETE BOX. CULVERT
BH	BORE HOLE
B.M	BENCH MARK
BOP	BEGINNING OF PROJECT
C	CHORD LENGTH
C.B.R	CALIFORNIA BEARING RATIO
C/C	CENTER TO CENTER
CHD.	CHECKED
C/L, ℄	CENTER LINE
CM/cm	CENTIMETER
CNGP	CNG PUMP
CONC.	CONCRETE
CONST/JT	CONSTRUCTION JOINT
CS	CURVE TO SPIRAL
CUL	CULVERT
Cu.m	CUBIC METER
CURVE LEN	VERTICAL CURVE LENGTH
D	DEPTH
Da	DEGREE OF CURVE (BY ARC)
Dc	DEGREE OF CURVE (BY CHORD)
DEG	DEGREE
DIA.	DIAMETER
D/S	DOWNSTREAM
D.S.T	DOUBLE SURFACE TREATMENT
DRG.	DRAWING
E	EASTING , EAST , EXTERNAL DISTANCE (SHIFT)
ELEV./EL	ELEVATION
EOP	END OF PROJECT
EP	ELECTRIC POLE
EXP/JT	EXPANSION JOINT
FP	FILLING POINT
F.R.L	FINISHED ROAD LEVEL
G.I	GALVANIZED IRON
H/HOR.	HORIZONTAL
H.T/L.T	HIGH TENSION/LOW TENSION
HF	HEIGHT OF FILL
HFL	HIGH FLOOD LEVEL
HWY.	HIGHWAY
I	DEFLECTION ANGLE (HORIZONTAL CURVE)
Ic	CIRCULAR DEFLECTION ANGLE
I.L	INVERT LEVEL
IS	SPIRAL DEFLECTION ANGLE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
Kg.	KILOGRAM
KM/Km	KILOMETER
L	LENGTH OF HORIZONTAL CURVE/SPIRAL
LIN.M	LINEAR METER
LHS.	LEFT HAND SIDE
LT.	LEFT
LT	LONG TANGENT
M/m	METER
M	MIDDLE ORDINATE
MAX.	MAXIMUM
M.H	MAN HOLE
MIN.	MINIMUM
mm	MILLIMETER

NSL/E.R.L	NATURAL SURFACE LEVEL / EXISTING ROAD LEVEL
N	NORTHING, NORTH
NO.	NUMBER
N.T.S	NOT TO SCALE
PC	POINT OF HORIZONTAL CURVATURE (START OF HORIZONTAL CURVE)
PC	PIPE CULVERT
PI	POINT OF HORIZONTAL INTERSECTION
PR	POINT OF ROTATION
PT	POINT OF HORIZONTAL TANGENCY (END OF HORIZONTAL CURVE)
R	RADIUS OF HORIZONTAL CURVE
R.C.C	REINFORCED CEMENT CONCRETE
REINF.	REINFORCEMENT
REV.	REVISION
RHS.	RIGHT HAND SIDE
R.O.W.	RIGHT OF WAY
R.R	RIP RAP
RT.	RIGHT
R/W	RETAINING WALL
RWC	RELOCATED WATER COURSE
S	SLOPE GRADIENT (PERCENT)
SE	SUPERELEVATION
S.B.P	SHOULDER BREAK POINT
SC	SLAB CULVERT
SC	SPIRAL TO CURVE
SHLD	SHOULDER
Sq.m	SQUARE METER
ST	SHORT TANGENT
ST	SPIRAL TO TANGENT
STA./CH.	STATION (CHAINAGE)
STRUCT	STRUCTURE
S'WALK	SIDE WALK
T	TANGENT LENGTH OF HORIZONTAL CURVE
T.D	TOE DITCH
TS	TANGENT TO SPIRAL
T.S.T	TRIPPLE SURFACE TREATMENT
TAN.	TANGENT
TH	THICKNESS
TP	TRAVERSE POINT
TR	TRANSITION
TYP.	TYPICAL
U/S	UPSTREAM
V	VERTICAL
VAR.	VARIABLE
VER.	VERIFIED
VPC	VERTICAL POINT OF CURVATURE (START OF VERTICAL CURVE)
VPI	VERTICAL POINT OF INTERSECTION OF PROFILE GRADE.
VPT	VERTICAL POINT OF TANGENCY (END OF VERTICAL CURVE)
W.	WEST, WIDTH OF ROADWAY
W.B.M	WATER BOUND MACADAM
WC	WATER COURSE
X	DISTANCE, IN THE DIRECTION OF TANGENT, FROM BEGINNING TO THE END OF SPIRAL SKEW ANGLE

NOTES

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:
MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
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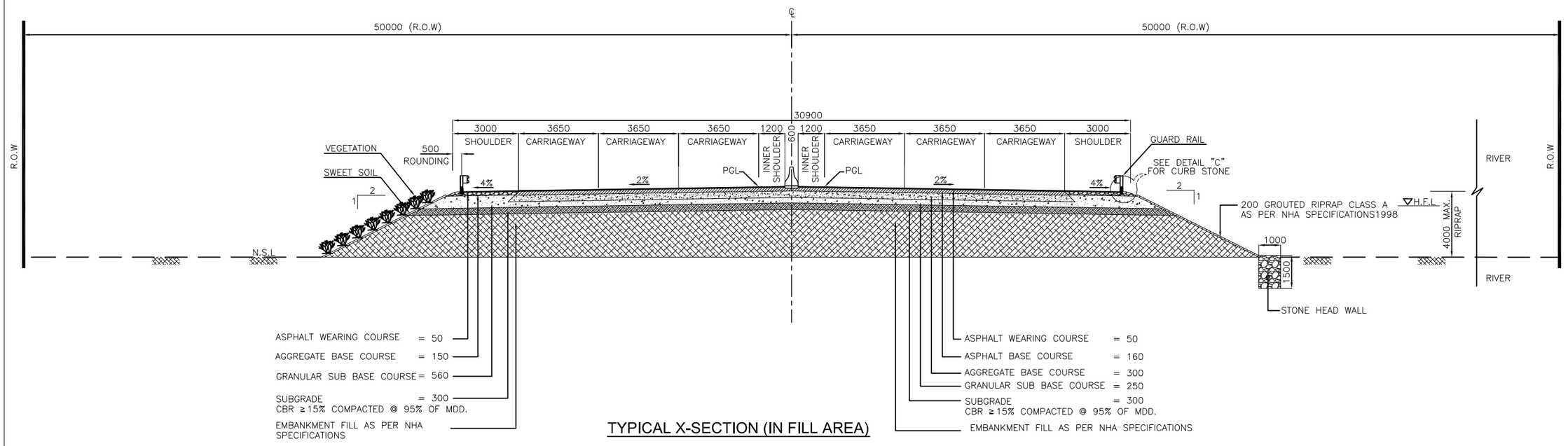
Ph: 051-4938213-4, FAX: 051-4938215

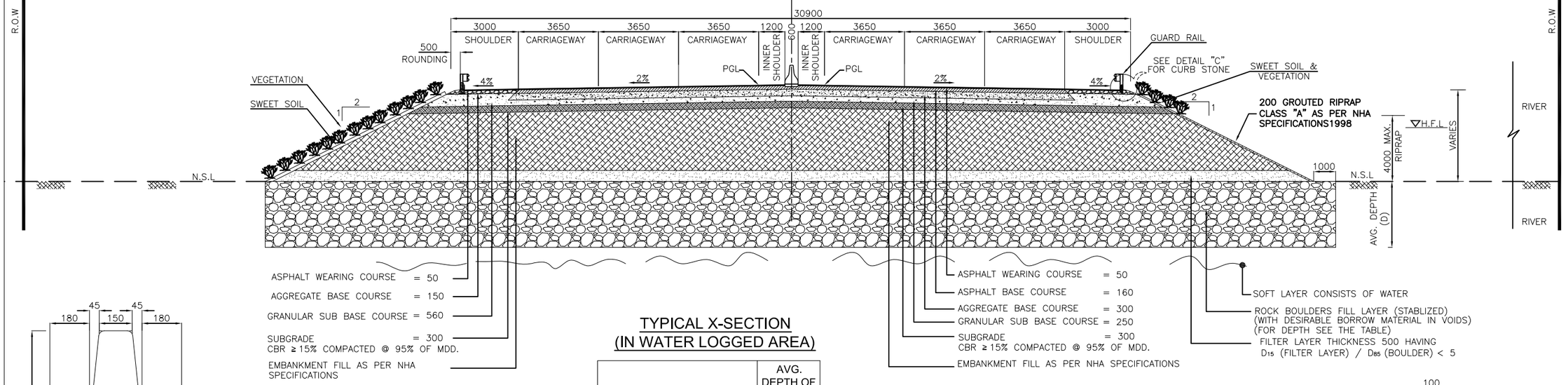
DRAWING TITLE:
LEGEND ABBREVIATION

DESIGN BY: AYESHA SHABBIR	SHEET NO:
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:
LOYA-ZI/MEW/GEN/02

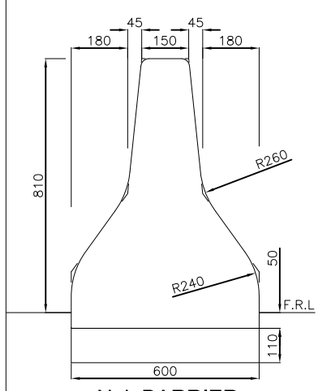


TYPICAL X-SECTION (IN FILL AREA)

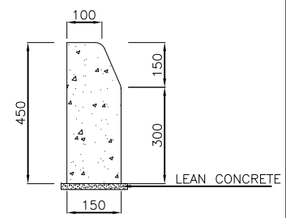


TYPICAL X-SECTION (IN WATER LOGGED AREA)

CHAINAGE	AVG. DEPTH OF BOLLDERS (D)
KM 3+500 TO 8+681	2.0 M
KM 9+586.5 TO 14+280.136	2.0 M



N.J. BARRIER



DETAIL "C" (PRECAST CURB STONE SECTION)

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER UNLESS NOTED OTHERWISE
2. ALL LAYERS SHALL BE PREPARED AS PER N.H.A.GENERAL SPECIFICATION
3. **GROUTED RIPRAP PROTECTION UP TO 4.0 METER MAXIMUM. REMAINING PART EMBANKMENT SLOPE WILL BE PROTECTED WITH SWEET SOIL AND VEGETATION.**
4. **FOR ROCK BOULDERS FILL LAYER SEE THE TABLE MENTIONED BELOW THE SECTION (SLUSHY POND AREA).**

LEGENDS

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:
MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
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3rd Floor, Time Square Plaza, I-8 Markaz, Islamabad
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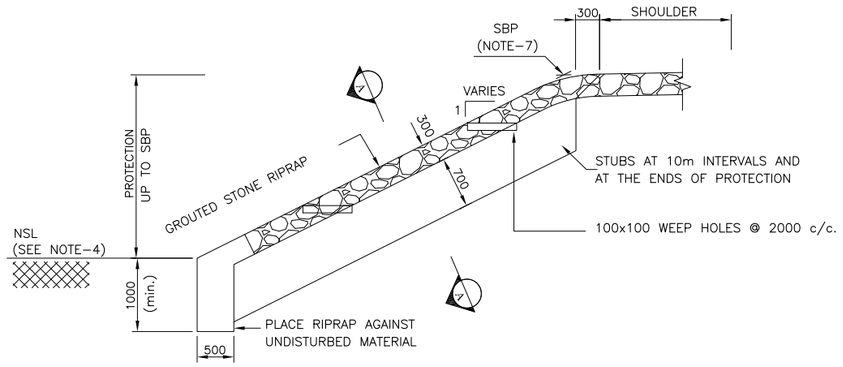
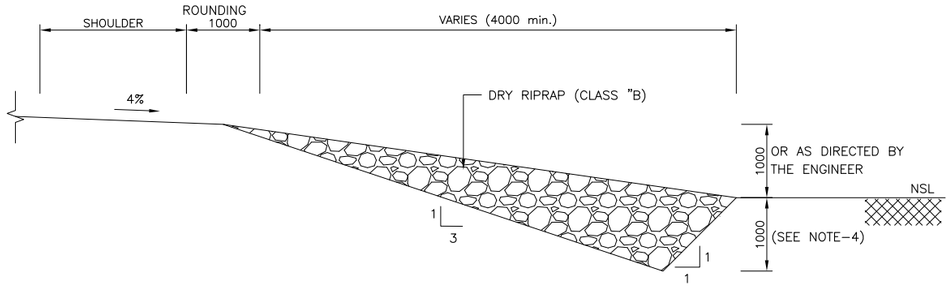
DRAWING TITLE:
TYPICAL CROSS SECTION

DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY:	SCALE:
RAJA FARHAT	N.T.S.
CHECKED BY:	DATE:
ZAFAR ALI	SEP, 2020
APPROVED BY:	REVISION:
M. ANWAR	REV. 00

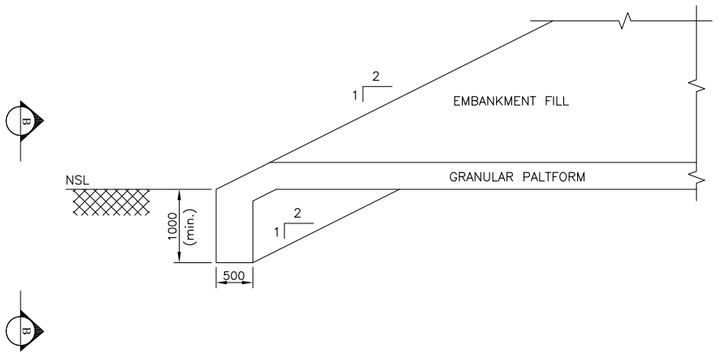
CAD FILE NAME:
LOYA-ZI/MEW/GEN/04



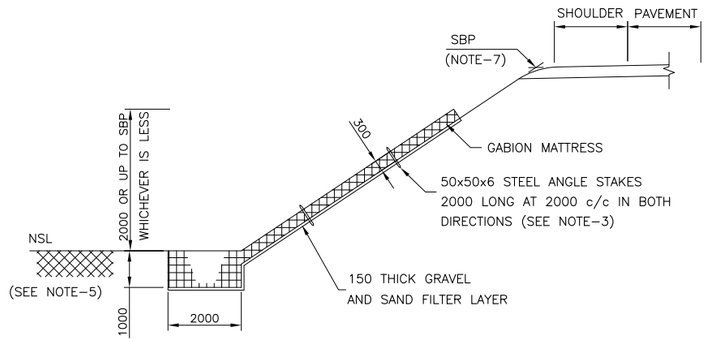
GROUTED STONE RIPRAP PROTECTION
(EP-1)



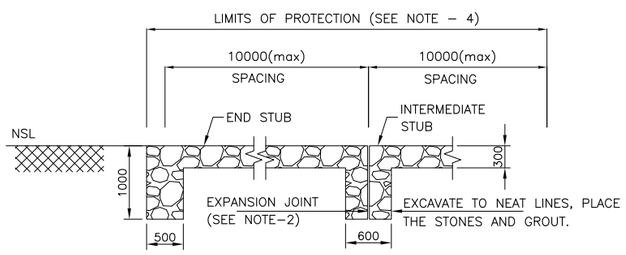
DRY RIPRAP PROTECTION
(EP-2)



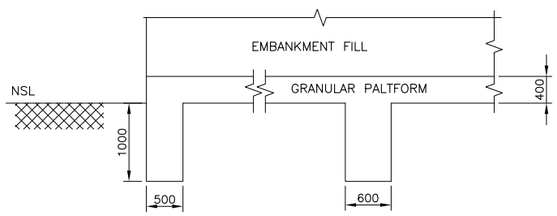
GRANULAR PLATFORM EARTHEN DOWEL
(EP-4)



GABION MATTRESS PROTECTION
(EP-3)



SECTION A-A



SECTION B-B

NOTES

ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

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(DESIGN AND FINANCIAL
CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

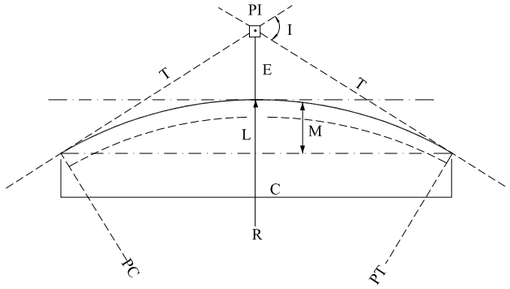
DRAWING TITLE:

TYPICAL EMBANKMENT
PROTECTION DETAILS

DESIGN BY: AYESHA SHABBIR	SHEET NO:
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

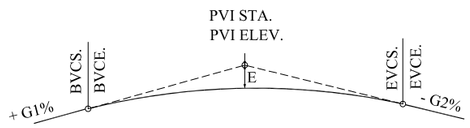
CAD FILE NAME:

LOYA-ZI/MEW/GEN/05



I = Angle Of Deflection
R = Radius Of Curvation (meter)
D = Degree Of Curve (degree)
T = Tangent Length (metre)
E = Extrnal Distance (metre)
Pc = Point Of Curvature
Pt = Point Of Tangency
L = Length Of Curve
C = Chord Length (metre)
M = Mide Ordinate (metre)

DETAILS OF HORIZONTAL CURVE



PVI. = Point of vertical intersection
ELEV. = Elevation
STA. = Station
BVCS. = Beginning of vertical curve station
BVCE. = Beginning of vertical curve elevation
EVCS. = End of vertical curve station
EVCE. = End of vertical curve elevation
LVC. = Length of vertical curve
K = K–factor (rate of vertical curvature)

DETAILS OF VERTICAL CURVE

GEOMETRIC STANDARDS

Design Parameters	Unit	Values	Reference: Ashto Guid 2004 Page No.
Design Speed	Km/hr		
Cross Section Elements:			
Lane Width	m	3.65	
Shoulder Width (outer Side)	m	3.00	314
Shoulder Width (inner Side)	m	1.20	314
Crossfall Of Carriageway	%	2.0	316
Crossfall Of Shoulder	%	4.0	316
Vertical Clearance - Bridge	m	5.2	
Vertical Clearance - Under Pass	m	4.5	
Horizontal Alignment			
Minimum Stopping Sight Distance	m	185	112
Minimum Radius For Open Expressway	m	492	168
Travelled Way Widening		see table-AASHTO	215
Maximum Superelevation Rate	–	4%	147
Vertical Alignment			
Maximum Longitudinal Grade	%	4.0%	150, 151
Minimum Longitudinal Grade	%	0.2%	150, 151
Minimum Crest Vertical Cuves (rate Of Vertical Curvature,k)	–	52	272
Minimum Sag Vertical Curves (rate Of Vertical Curvature,k)	–	45	277

NOTES

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:
MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
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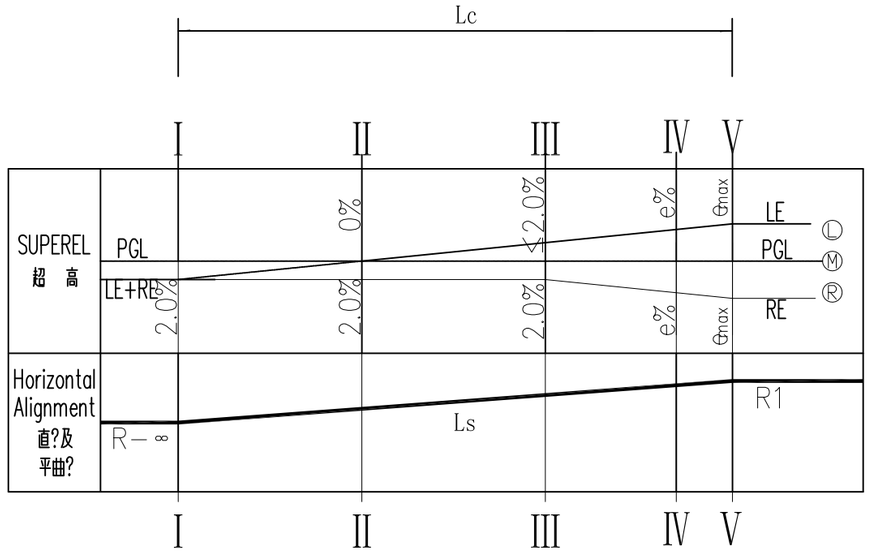
3rd Floor, Time Square Plaza, I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:
GEOMETRIC DESIGN CRITERIA

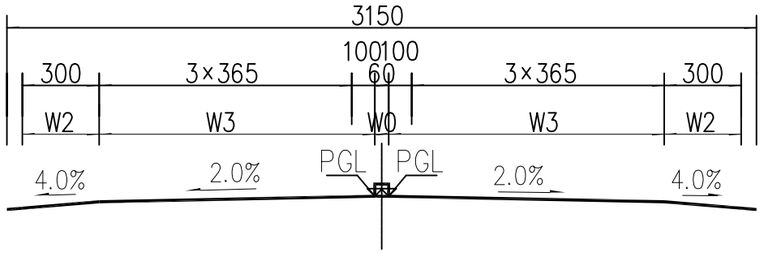
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:
LOYA-ZI/MEW/GEN/07

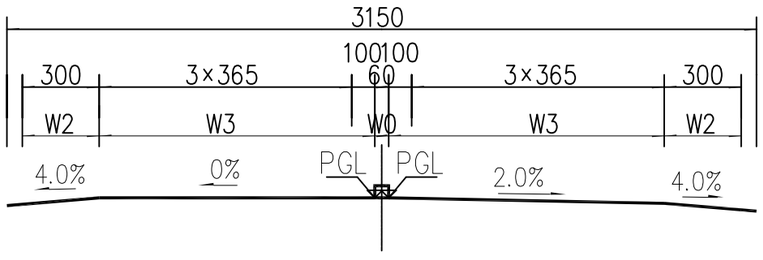
Lc=Ls



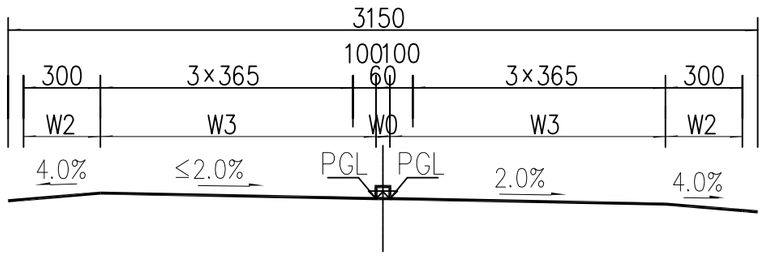
I—I Cross Section



II—II Cross Section



III—III Cross Section



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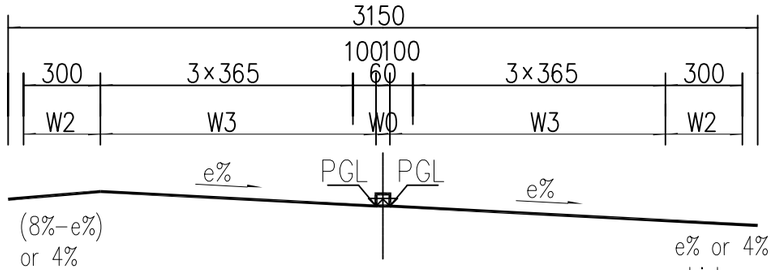
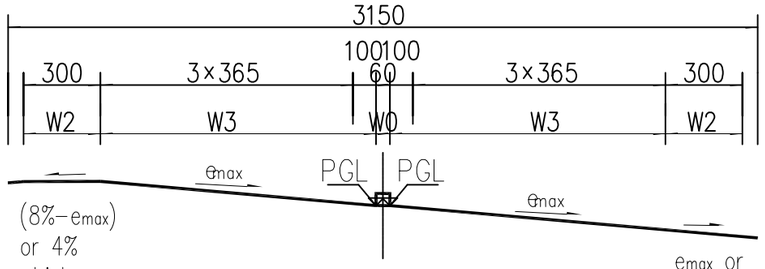


V—V Cross Section



NOTES

1¡¢All dimensions are in centimeter unless noted otherwise¡£

2¡¢Transition form of superelevation: revolution around the median edges. PGL means Profile Level£¬W3¡¢W2 mean respectively the width of carriageway¡¢shoulder .

3¡¢Lc is the length of the superelevation transition section,an equivalent length with spiral curves (Lc=Ls).

4¡¢The cross slope of outer shoulder be kept (8%-emax) or 4% whichever is minimum,inner shoulder should be kept emax or 4% whichever is maximum.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

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ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

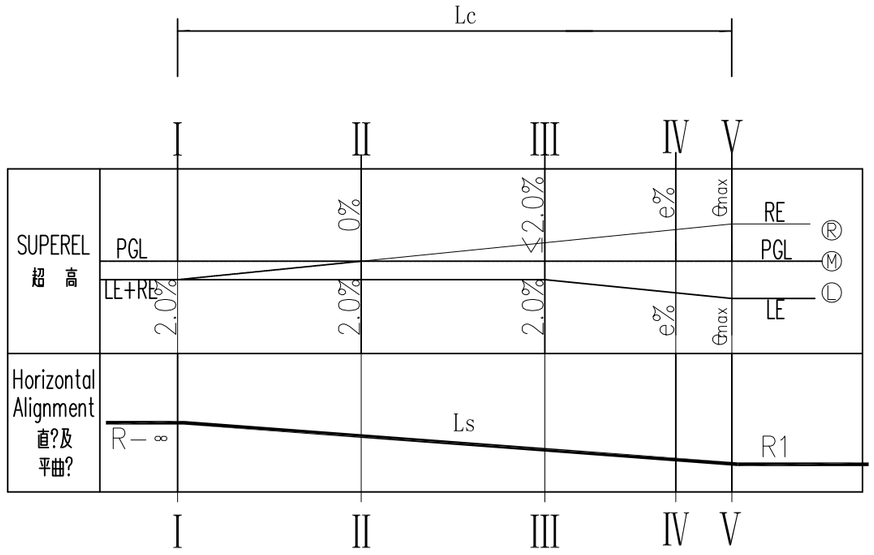
SUPER ELEVATION TRANSITION LAYOUT DIAGRAM AT EXPRESSWAY FOR RIGHT CURVE(1)

DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

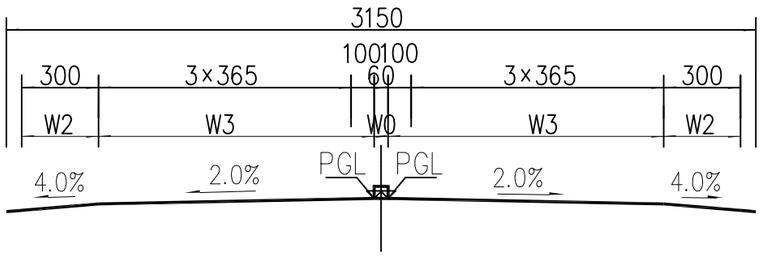
CAD FILE NAME:

LOYA-ZI/MEW/GEN/08

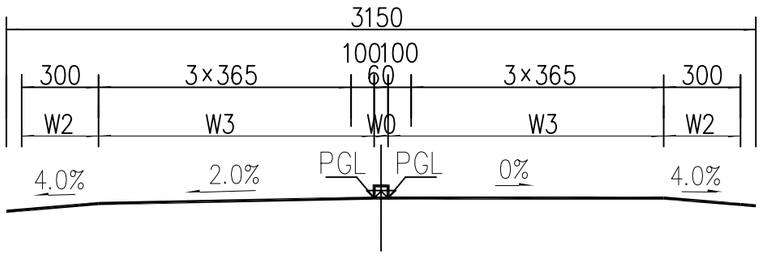
Lc=Ls



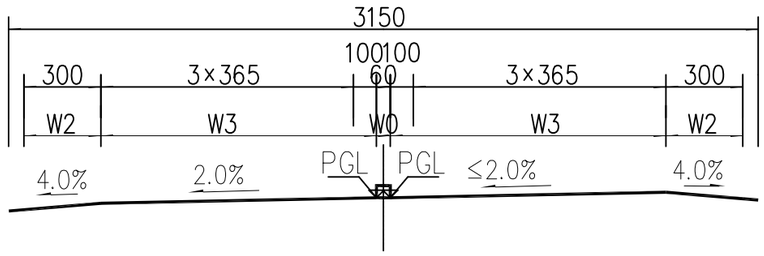
I−I Cross Section



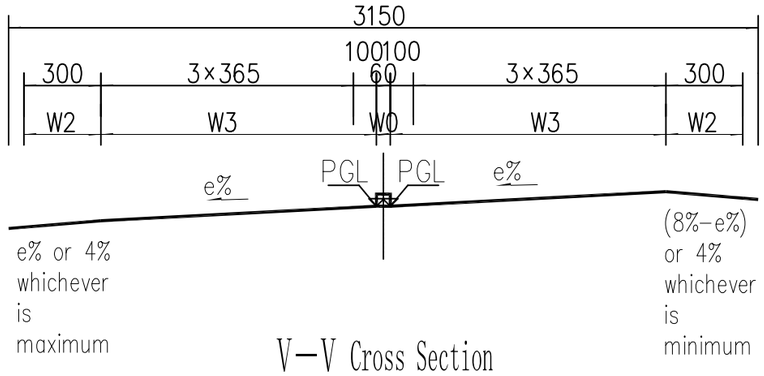
II−II Cross Section



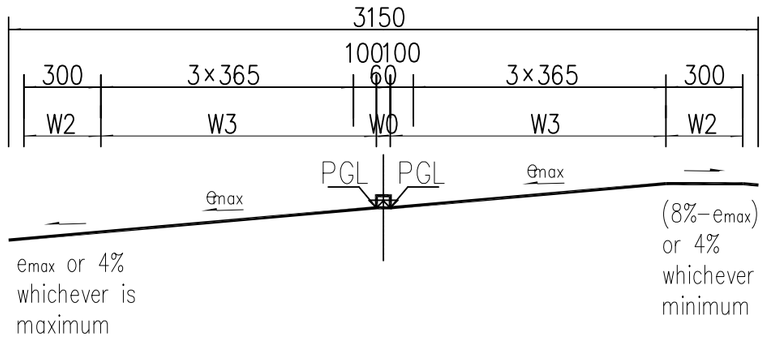
III−III Cross Section



IV−IV Cross Section



V−V Cross Section



NOTES

1¡¢All dimensions are in centimeter unless noted otherwise¡£

2¡¢Transition form of superelevation: revolution around the median edges. PGL means Profile Level£¬W3¡¢W2 mean respectively the width of carriageway¡¢shoulder .

3¡¢Lc is the length of the superelevation transition section,an equivalent length with spiral curves (Lc=Ls).

4¡¢The cross slope of outer shoulder be kept (8%-emax) or 4% whichever is minimum,inner shoulder should be kept emax or 4% whichever is maximum.

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:
MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
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Ph: 051-4938213-4, FAX: 051-4938215

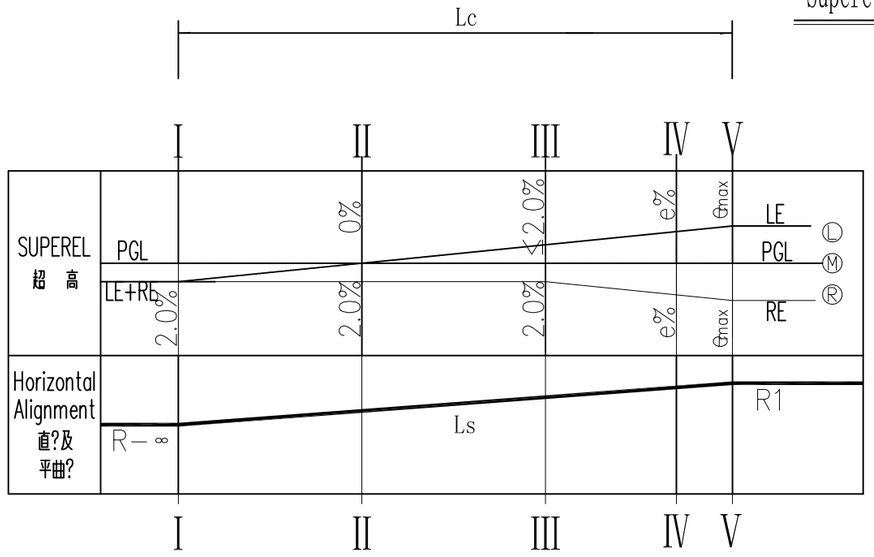
DRAWING TITLE:
SUPER ELEVATION TRANSITION
LAYOUT DIAGRAM AT EXPRESSWAY
FOR LEFT CURVE(2)

DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY:	SCALE:
M. SHAKEEL	N.T.S.
CHECKED BY:	DATE:
ZAFAR ALI	SEP, 2020
APPROVED BY:	REVISION:
M. ANWAR	REV. 00

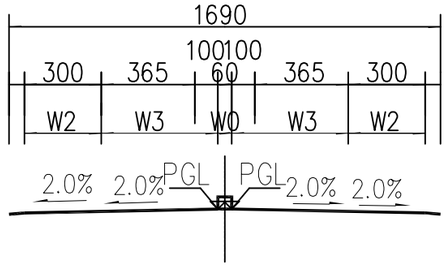
CAD FILE NAME:
LOYA-ZI/MEW/GEN/08-A

Superelevation at Interchange

Lc=Ls



I—I Cross Section



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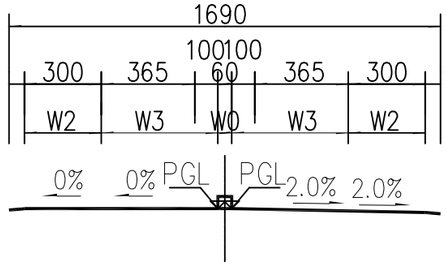
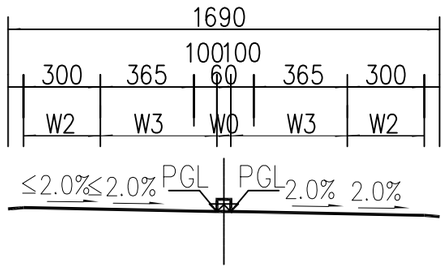
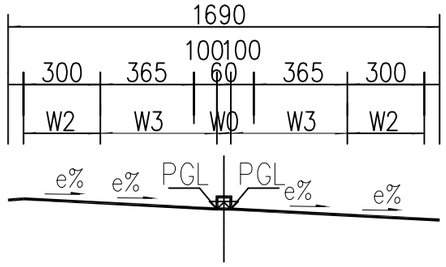


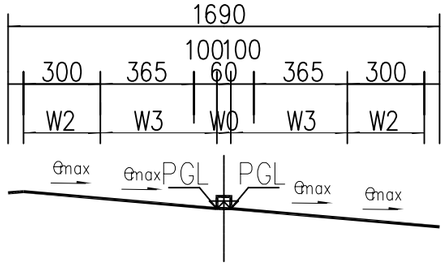
III—III Cross Section



IV—IV Cross Section



V—V Cross Section



NOTES

1¡¢All dimensions are in centimeter unless noted otherwise¡£

2¡¢Transition form of superelevation: revolution around the median edges. PGL means Profile Level£¬W3¡¢W2 mean respectively the width of carriageway¡¢shoulder .

3¡¢Lc is the length of the superelevation transition section,an equivalent length with spiral curves (Lc=Ls).

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

SUPER ELEVATION TRANSITION AT INTERCHANGE ON TWO WAY RAMP FOR RIGHT CURVE(1)

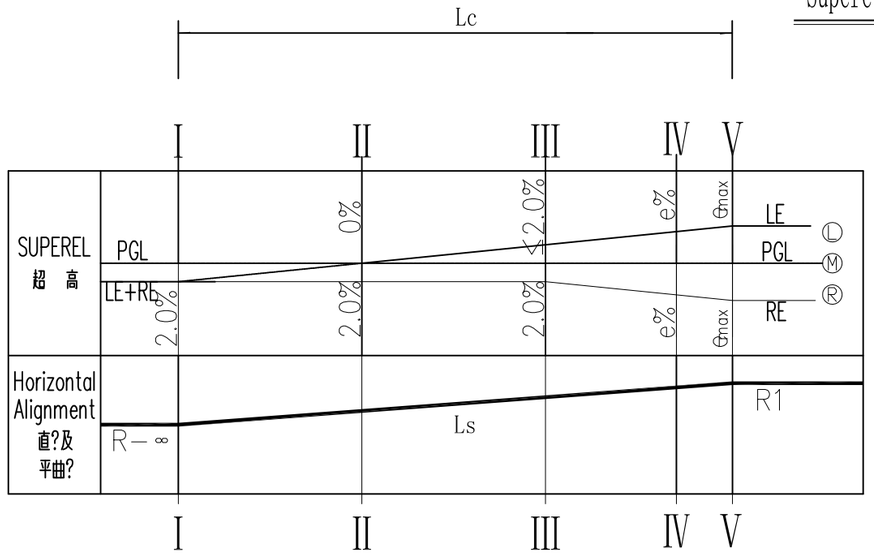
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY:	SCALE:
M. SHAKEEL	N.T.S.
CHECKED BY:	DATE:
ZAFAR ALI	SEP, 2020
APPROVED BY:	REVISION:
M. ANWAR	REV. 00

CAD FILE NAME:

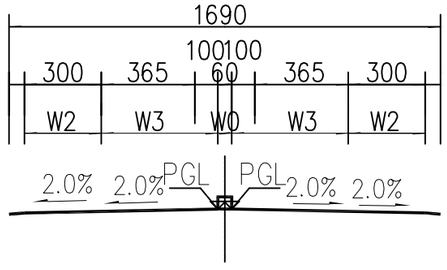
LOYA-ZI/MEW/GEN/08-B

Superelevation at Interchange

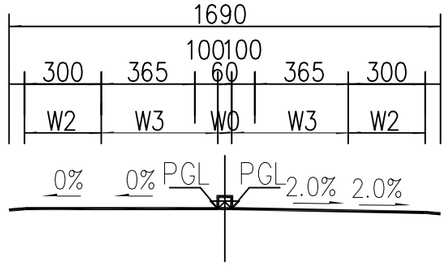
Lc=Ls



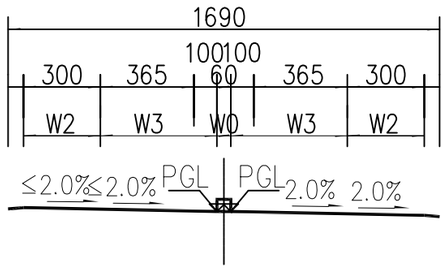
I－I Cross Section



II－II Cross Section



III－III Cross Section



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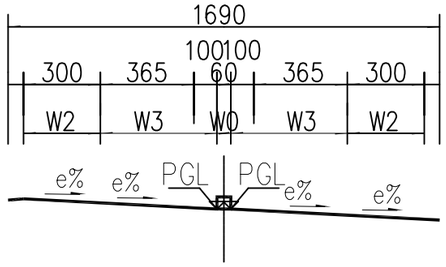

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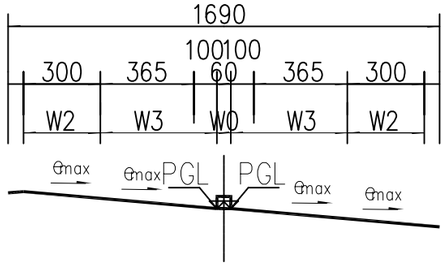

NOTES

1¡¢All dimensions are in centimeter unless noted otherwise¡£

2¡¢Transition form of superelevation: revolution around the median edges. PGL means Profile Level£¬W3¡¢W2 mean respectively the width of carriageway¡¢shoulder .

3¡¢Lc is the length of the superelevation transition section,an equivalent length with spiral curves (Lc=Ls).

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

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3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

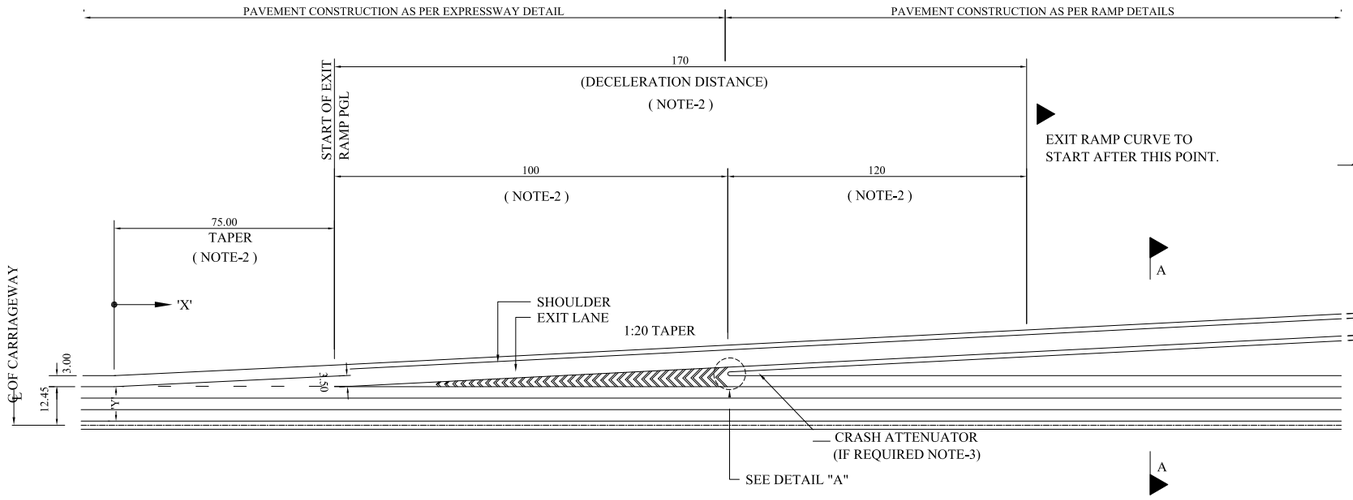
DRAWING TITLE:

SUPER ELEVATION TRANSITION AT INTERCHANGE ON TWO WAY RAMP FOR LEFT CURVE(2)

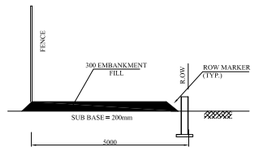
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY:	SCALE:
M. SHAKEEL	N.T.S.
CHECKED BY:	DATE:
ZAFAR ALI	SEP, 2020
APPROVED BY:	REVISION:
M. ANWAR	REV. 00

CAD FILE NAME:

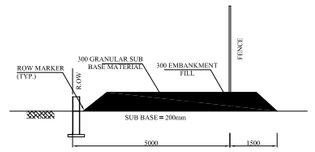
LOYA-ZI/MEW/GEN/08-C



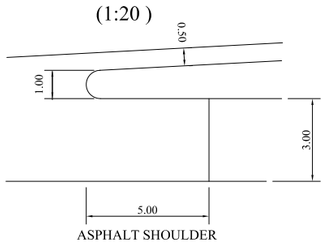
EXIT RAMP PLAN



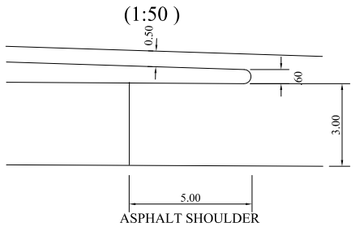
EARTHEN TRACK DETAILS SECTION A-A
Scale: 1:100



EARTHEN TRACK DETAILS SECTION B-B
Scale: 1:100



DETAIL "A"



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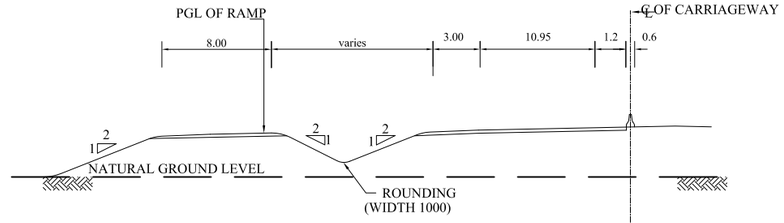
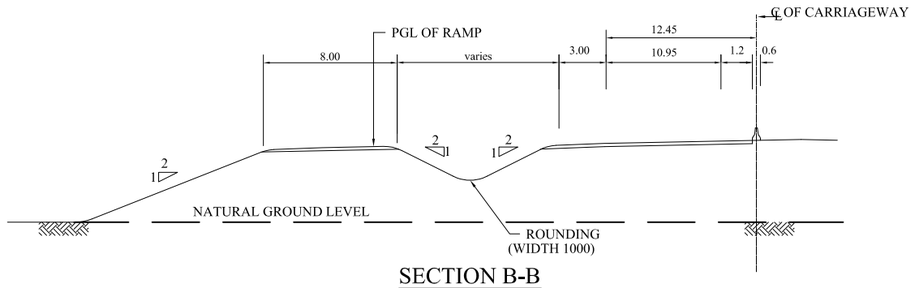
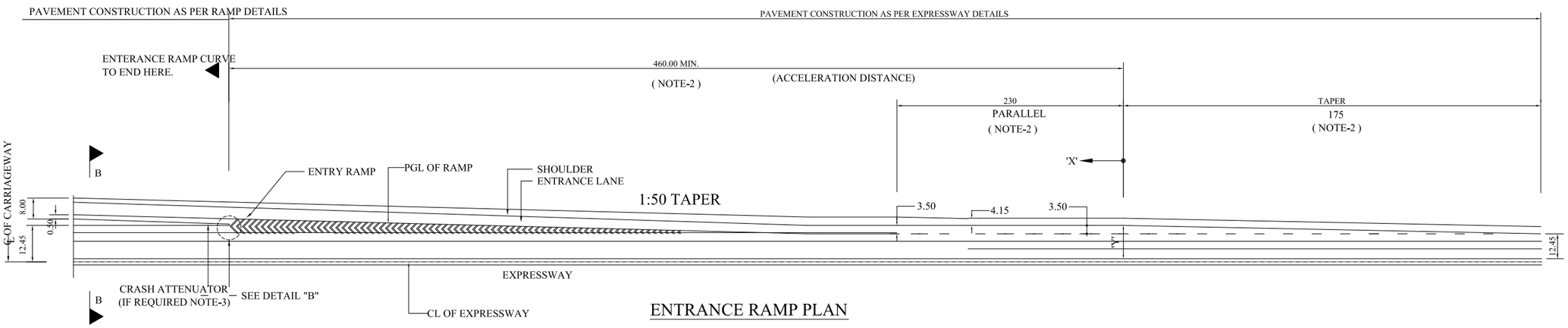


SECTION A-A



SECTION B-B



ENTRANCE RAMP PLAN

NOTES:-

1:- ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2:- ACCELERATION AND DECELERATION DISTANCES AS PROVIDED HERE SHOULD ONLY BE FOLLOWED WHEN NO DISTANCES ARE PROVIDED ON INTERCHANGE DRAWINGS.

NOTES

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:
MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:
TYPICAL LAYOUT PLAN AND CROSS SECTION FOR EXIT AND ENTRY RAMP

DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:
LOYA-ZI/MEW/GEN/09



WEIGH STATION



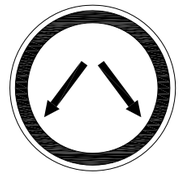
OBSERVE LANE



AVOID MOBILE



SEATBELT FASTEN



(R-1)
BIFURCATION SIGN



(R-2)
GIVE WAY SIGN



(W-1)
KEEP LEFT SIGN



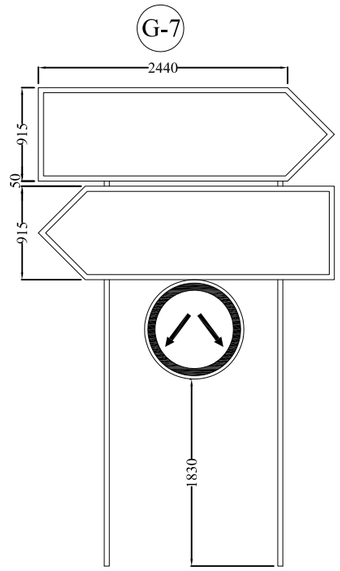
(W-4)
CHEVRON SIGN

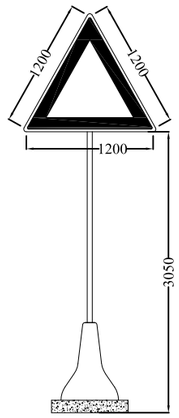


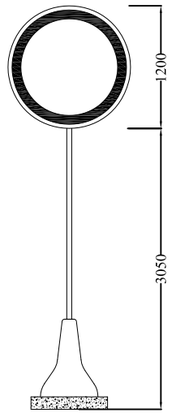
(R-5)
LANE MERGE



SPEED CAMERA AHEAD SIGN
(AFTER REGULAR INTERVAL)









R-11a



R-11b



R-12a



R-12b



R-13a



R-13b



R-14



NOTES

ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

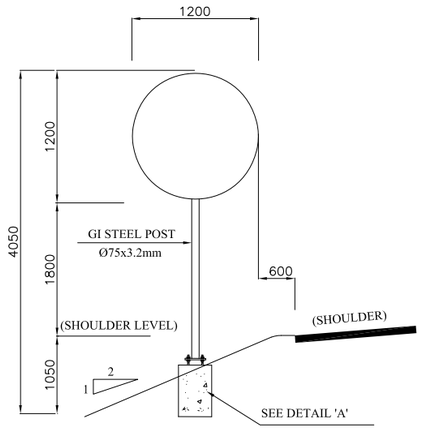
E.P.C. CONCESSIONAIRE:
MALIR EXPRESSWAY (PVT) LTD

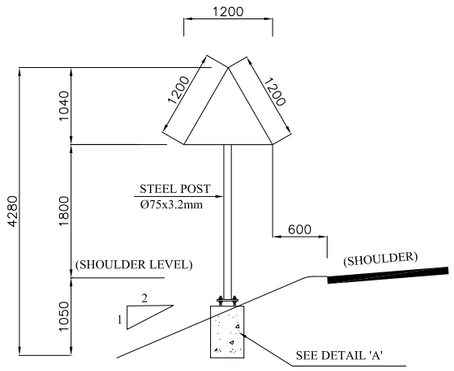
E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:
TRAFFIC SIGNS DETAILS

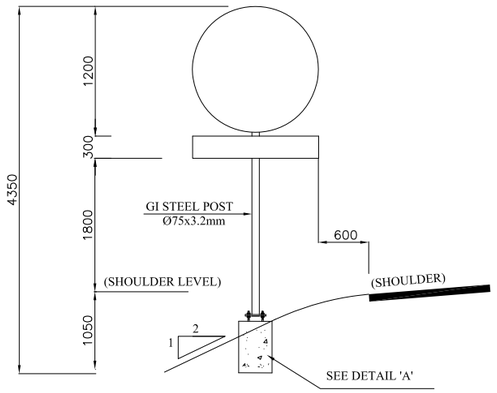
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

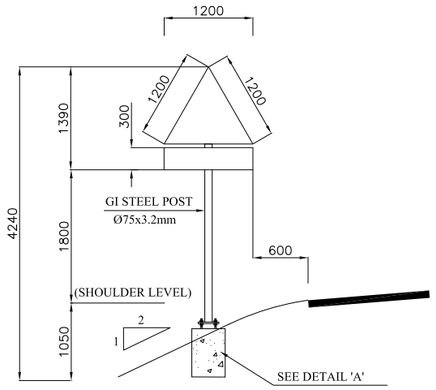
CAD FILE NAME:
LOYA-ZI/MEW/GEN/10



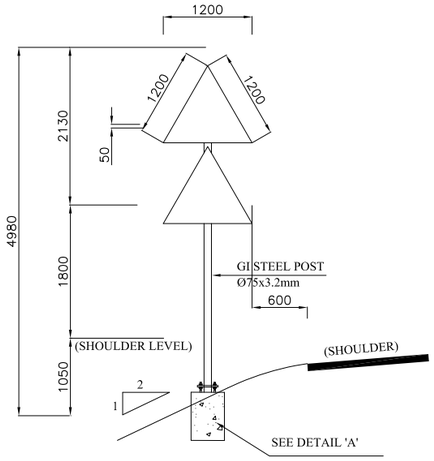


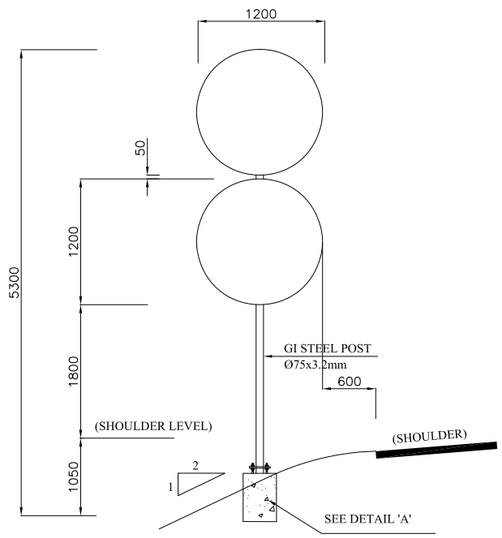
SINGLE SIGNS



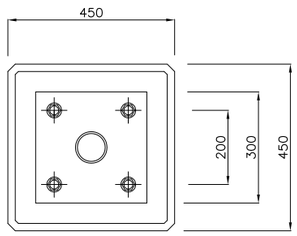


SINGLE SIGNS WITH ADDITIONAL PLATE

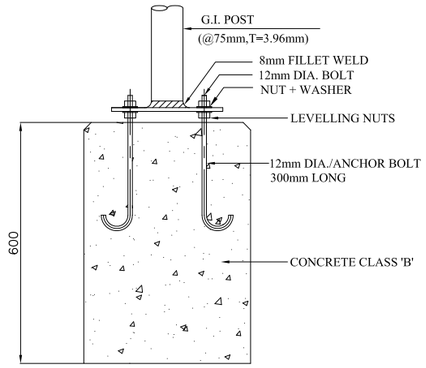




DOUBLE SIGNS



PLAN



SECTION

PRECAST CONCRETE FOUNDATION
(TYPE-1)

DETAIL 'A'

WARNING/REGULATORY (TRIANGLE/CIRCULAR)SIGNS.

NOTES

ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES
(DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

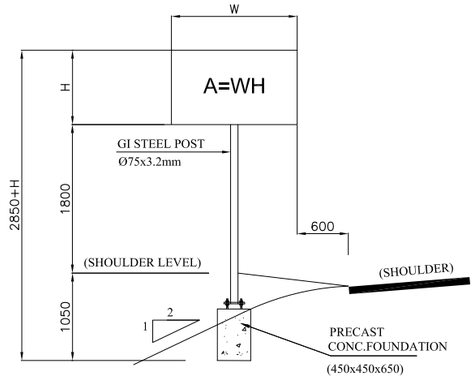
DRAWING TITLE:

TYPICAL PLACEMENT FOR ROAD SIGNS - 1

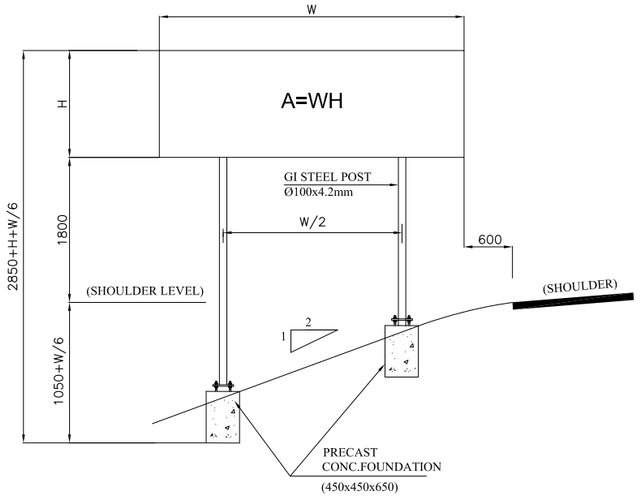
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY:	SCALE:
M. SHAKEEL	N.T.S.
CHECKED BY:	DATE:
ZAFAR ALI	SEP, 2020
APPROVED BY:	REVISION:
M. ANWAR	REV. 00

CAD FILE NAME:

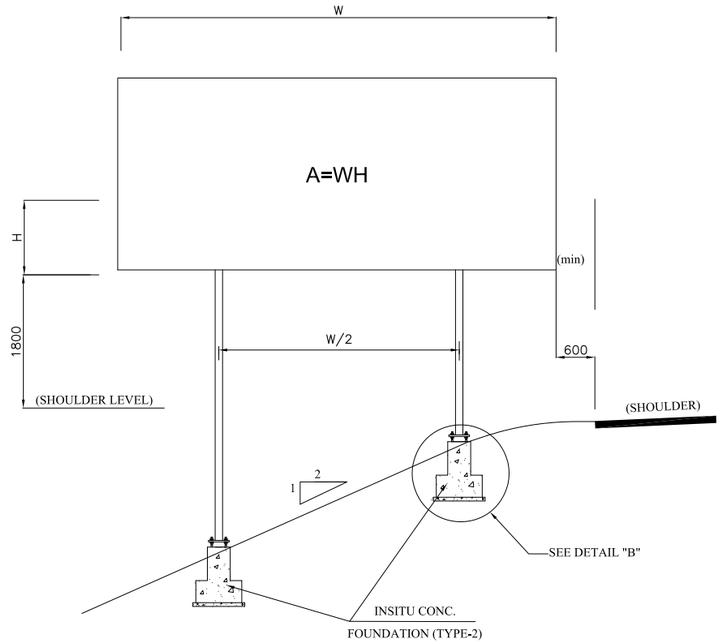
LOYA-ZI/MEW/GEN/11



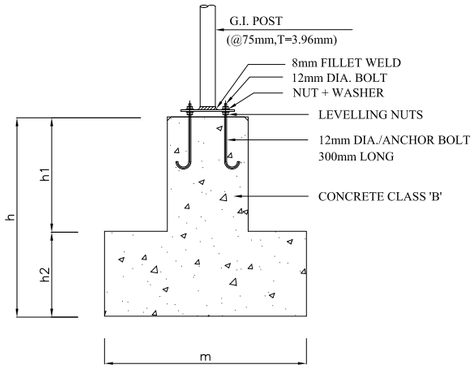
SINGLE POST (A<1.5m.^{2})



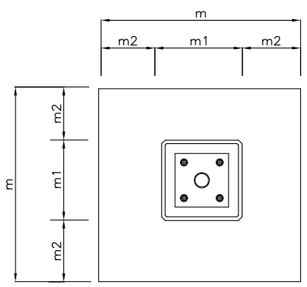
DOUBLE POST (A<3m.^{2})
FOUNDATION TYPE-1



DOUBLE POST (A<20m.^{2})
FOUNDATION TYPE-2



SECTION



PLAN

PRECAST CONCRETE FOUNDATION

(TYPE-2)

DETAIL 'B'

INFORMATION (RECTUNGULAR SIGNS)

TABLE - 1

LIST OF FOUNDATION SIZE

AREA OF SIGN BOARD (A) (M^2)	DIMENSION (M M)					
	m_1	m_2	m	h_1	h_2	h
3 <A ≤5	450	325	1100	600	400	1000
5 <A ≤10	600	400	1400	750	450	1200
10 ≤A ≤15	700	450	1600	900	500	1400
15<A<20	800	500	1800	1050	550	1600

NOTES:-

1- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.

2- POST LENGTH AS SHOWN ARE FOR EXPRESSWAY SIGNS OF 1200mm NOMINAL SIZE. FOR RAMPS, POST LENGTH SHALL BE ADJUSTED ACCORDINGLY.

3- PRECAST CONCRETE FOUNDATION BLOCKS SHALL BE CAST USING CLASS "B" CONCRETE.

4- SIGN PANELS SHALL BE MADE OF ALLUMINIUM ALLOY PLATES OF MINIMUM 3mm THICKNESS.

5- FOR ALL TRIANGULAR, CIRCULAR SIGNS AND INFORMATION SIGNS OF LESS THEN 1.5m Sq.m AREA, USE INNER DIA 75mm, 3.2mm THICK CIRCULAR GI POST WITH.

6- ALL SIGN POSTS SHALL BE PAINTED WITH NON-REFLECTORISED BLACK AND WHITE PAINT STRIPES 300mm WIDE.

7- ALL SIGN BACK PANNELS SHALL BE PAINTED WITH GREY ENAMEL PAINT.

8- ALL POSTS SHALL BE 300mm SHORT OF SIGN TOP.

NOTES

1- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2- POST LENGTH AS SHOWN ARE FOR EXPRESSWAY SIGNS OF 1200mm NOMINAL SIZE. FOR RAMPS, POST LENGTH SHALL BE ADJUSTED ACCORDINGLY.
3- PRECAST CONCRETE FOUNDATION BLOCKS SHALL BE CAST USING CLASS "B" CONCRETE.
4- SIGN PANELS SHALL BE MADE OF ALLUMINIUM ALLOY PLATES OF MINIMUM 3mm THICKNESS.
5- FOR ALL TRIANGULAR, CIRCULAR SIGNS AND INFORMATION SIGNS OF LESS THEN 1.5m Sq.m AREA, USE INNER DIA 75mm, 3.2mm THICK CIRCULAR GI POST WITH.
6- FOR SIGN LARGER THAN 3mSQ. FACE AREA, USE "H" SECTION POST AS SHOWN ON DRG. NO. LOYA-ZI/MEW/GEN/11C
7- ALL SIGN POSTS SHALL BE PAINTED WITH NON-REFLECTORISED BLACK AND WHITE PAINT STRIPES 300mm WIDE.
8- ALL SIGN BACK PANELS SHALL BE PAINTED WITH GRAY ENAMEL PAINT.
9- ALL POSTS SHALL BE 300mm SHORT OF SIGN TOP.

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

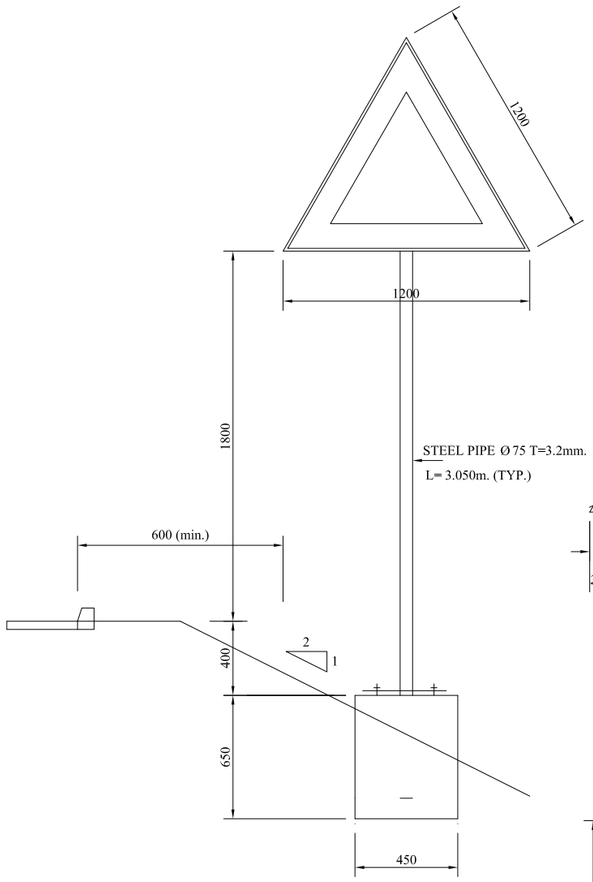
E.P.C. CONCESSIONAIRE:
MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

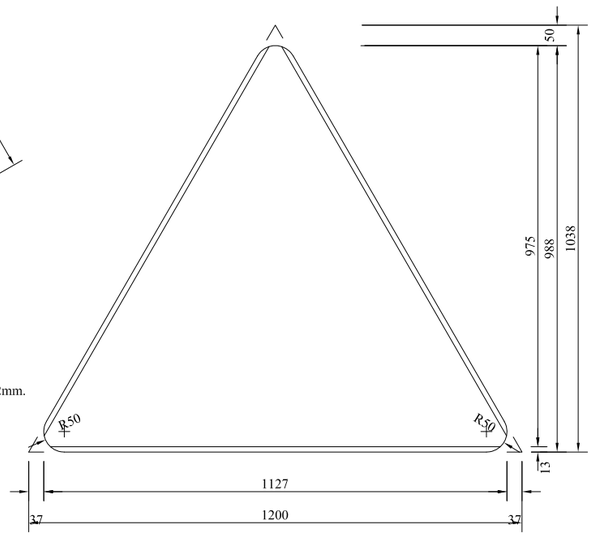
DRAWING TITLE:
TYPICAL PLACEMENT FOR ROAD SIGNS - 2

DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

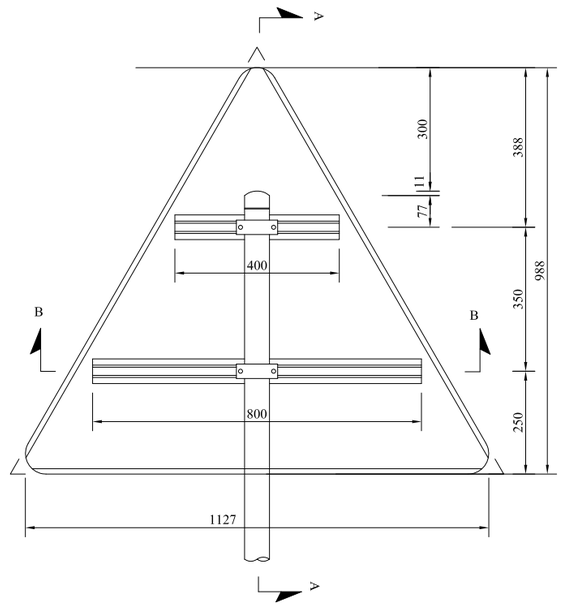
CAD FILE NAME:
LOYA-ZI/MEW/GEN/11A



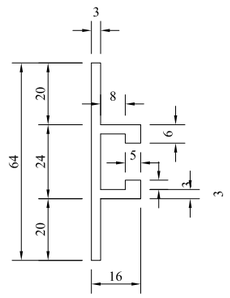
FRONT VIEW



FRONT VIEW



REAR VIEW



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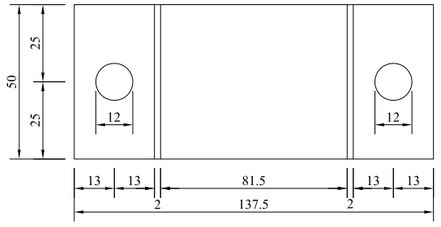

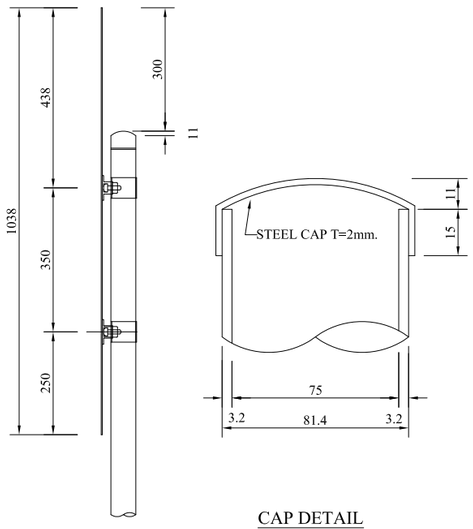

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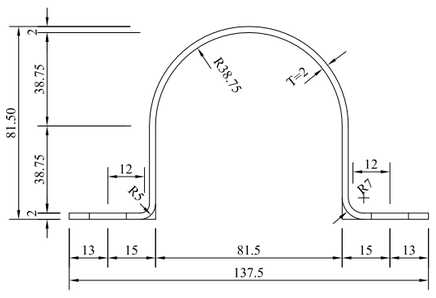
CAP DETAIL



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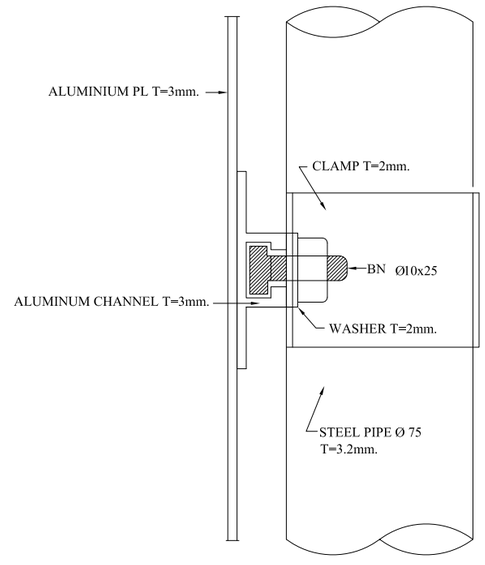
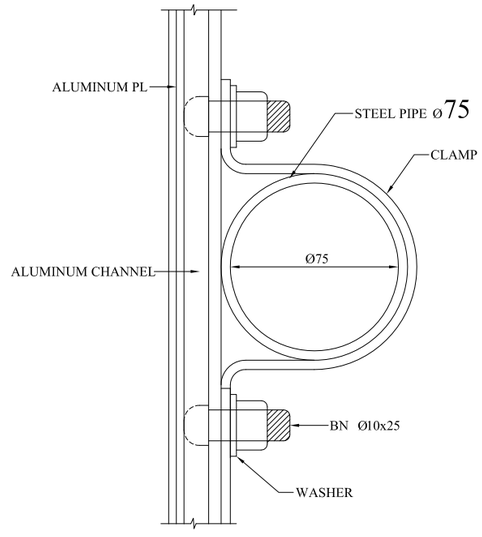


SECTION A-A



SECTION B-B

NOTES

ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

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3rd Floor, Time Square Plaza,
1-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

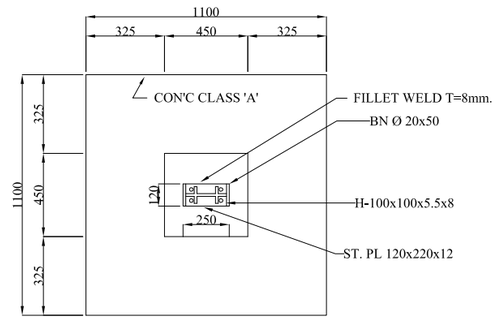
DRAWING TITLE:

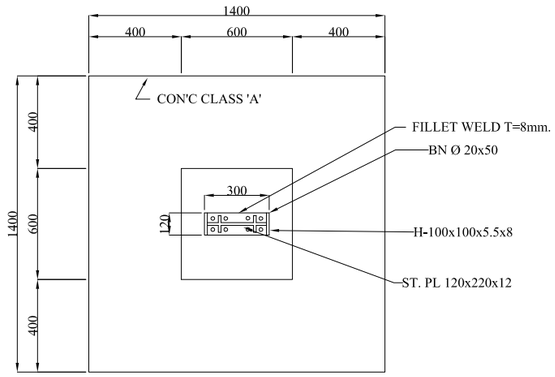
ROAD SIGN FIXATION DETAILS - 1

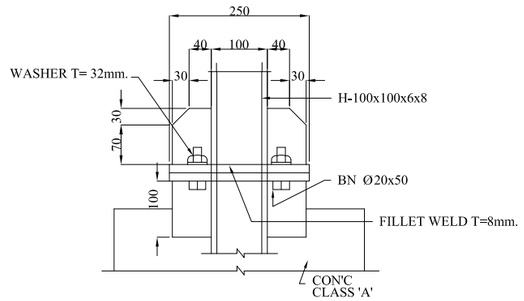
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/GEN/11B







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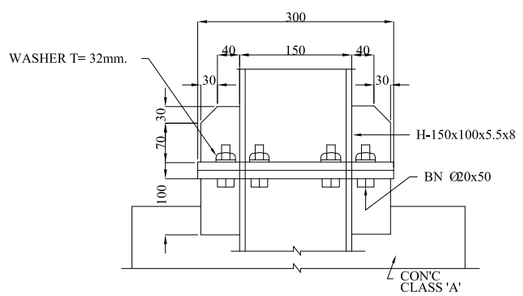

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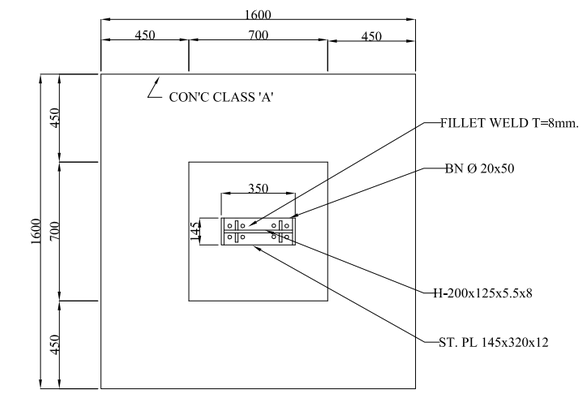

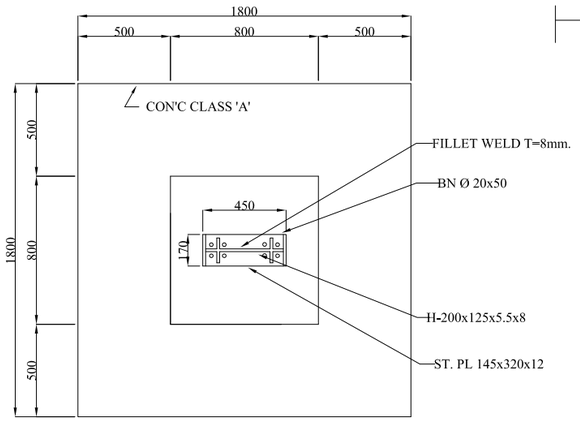

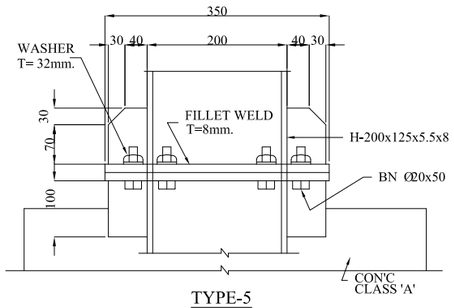

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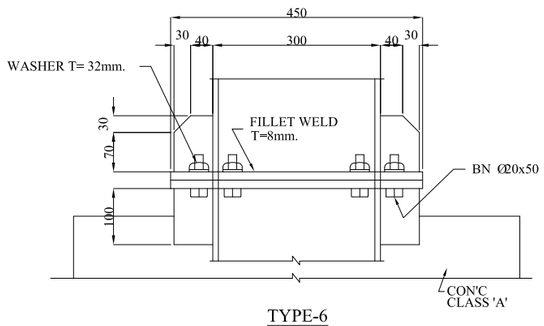

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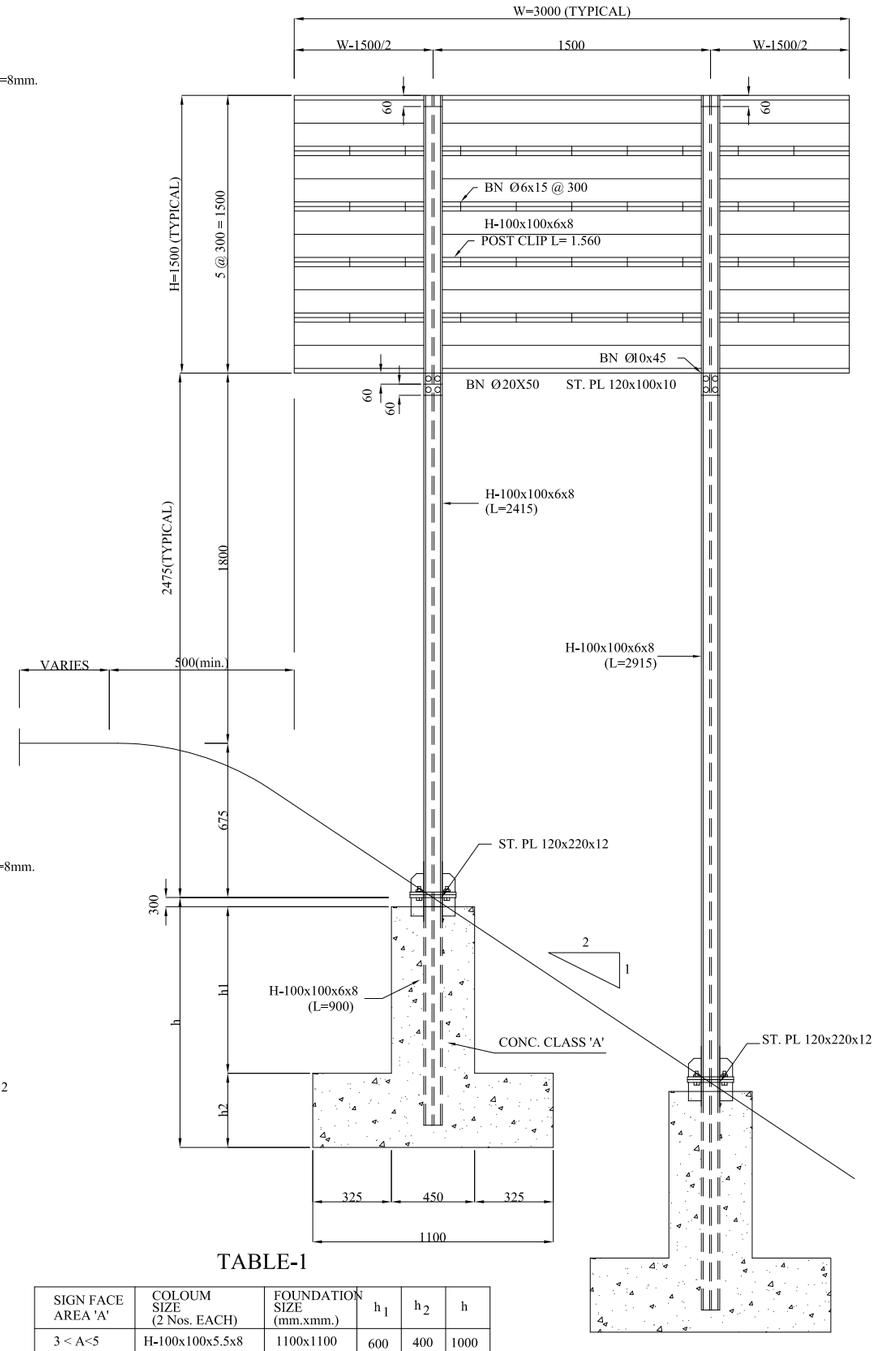

TYPICAL SIGN DETAILS
(FACE AREA <5m.^{2})

TABLE-1

SIGN FACE AREA 'A'	COLOUM SIZE (2 Nos. EACH)	FOUNDATION SIZE (mm.xmm.)	h_1	h_2	h
3 < A<5	H-100x100x5.5x8	1100x1100	600	400	1000
5 < A<10	H-150x100x5.5x8	1400x1400	750	450	1200
10< A<15	H-200x125x5.5x8	1600x1600	900	500	1400
15< A<20	H-300x150x5.5x8	1800x1800	1050	550	1600

FOR OTHER DETAILS,

NOTES

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REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

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ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

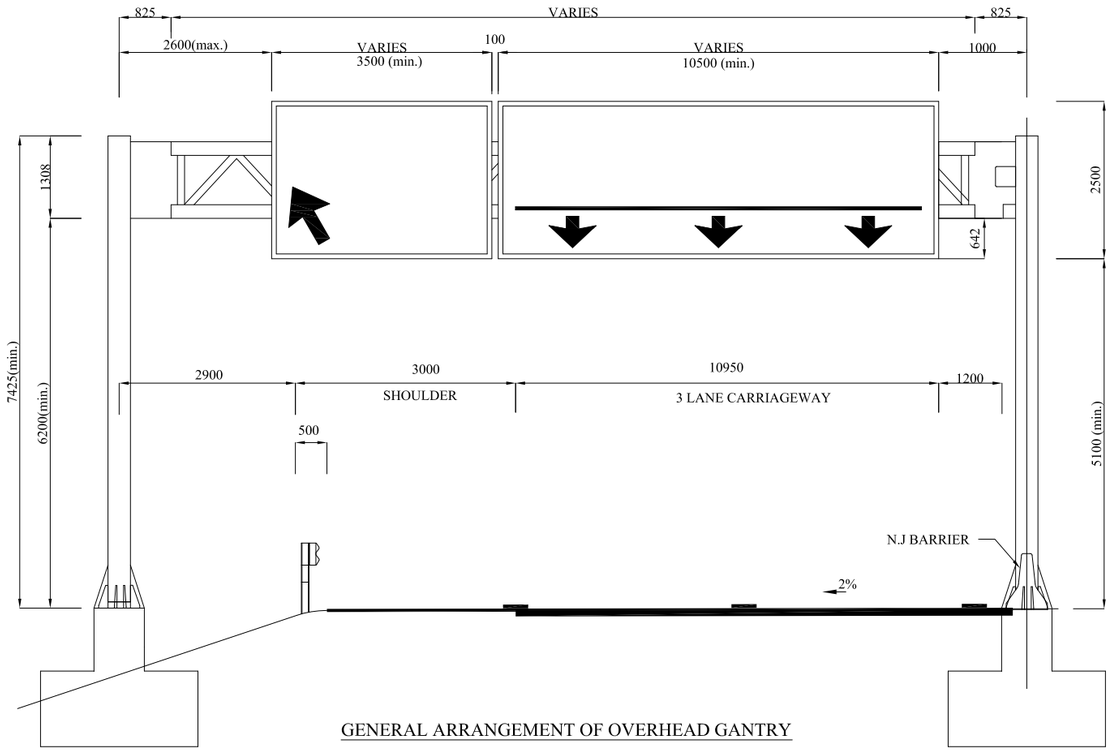
DRAWING TITLE:

ROAD SIGN FIXATION DETAILS - 2

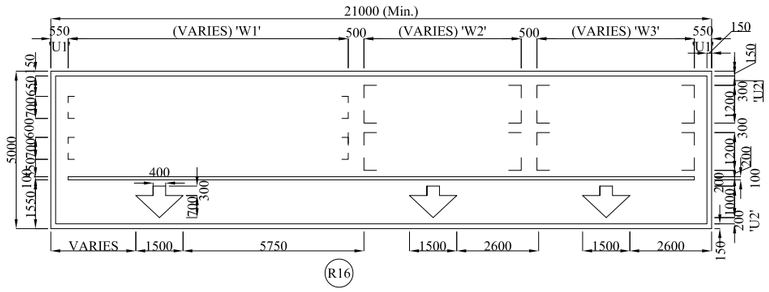
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

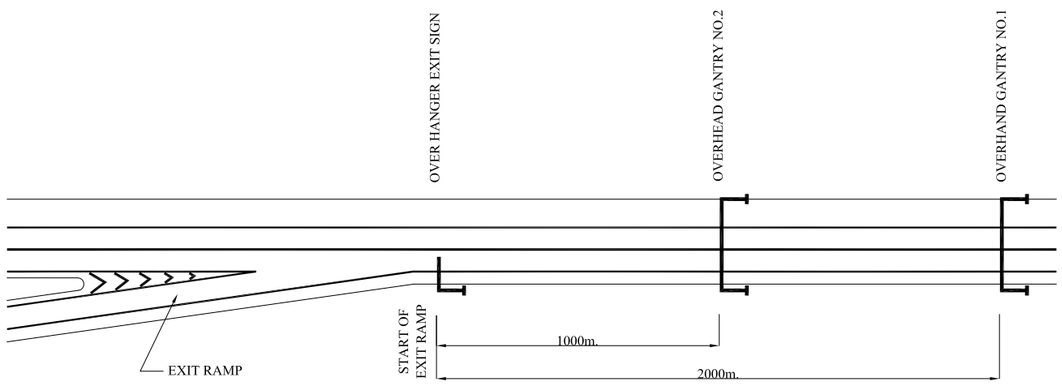
LOYA-ZI/MEW/GEN/11C



GENERAL ARRANGEMENT OF OVERHEAD GANTRY



OVERHEAD DESTINATION SIGN
AT GANTRY (TYP.FOR 3 LANES)
(2Km/1Km Short of exit ramp)



TYPICAL PLACEMENT OF OVERHEAD SIGNS AT EXIT RAMP

NOTES

1 - ALL DIMENSIONS ARE IN MILLIMETERS.
2 - GANTRY DIMENSIONS SHOWN IN THIS DRAWING ARE FOR NORMAL LOCATIONS WITH CROSS SLOPE OF 2%. EXACT DIMENSIONS SHALL BE WORKED AT KEEPING IN VIEW THE ACTUAL ROAD CROSS SECTION AT THE PROPOSED LOCATION TO ENSURE MINIMUM CLEARANCES AS SHOWN.

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

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(DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
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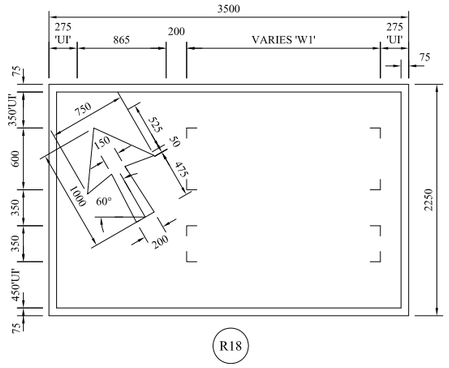
Ph: 051-4938213-4, FAX: 051-4938215

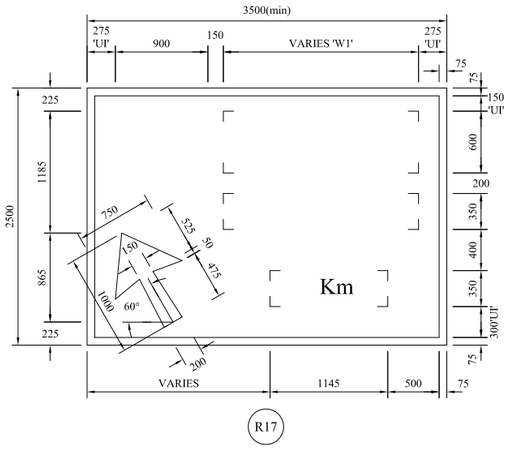
DRAWING TITLE:
GENERAL ARRANGEMENT OF OVERHEAD SIGNS

DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY:	SCALE:
M. SHAKEEL	N.T.S.
CHECKED BY:	DATE:
ZAFAR ALI	SEP, 2020
APPROVED BY:	REVISION:
M. ANWAR	REV. 00

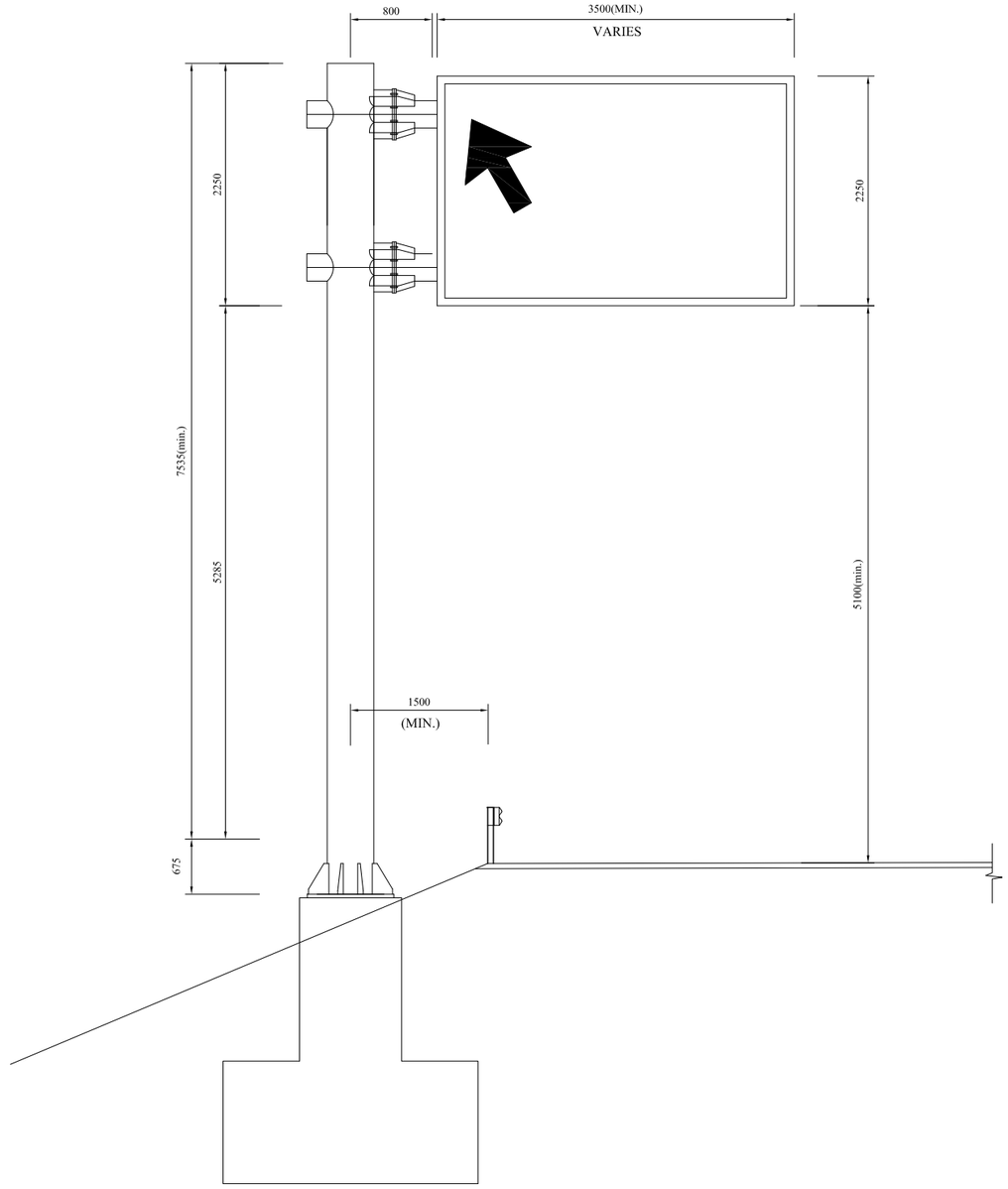
CAD FILE NAME:
LOYA-ZI/MEW/GEN/12



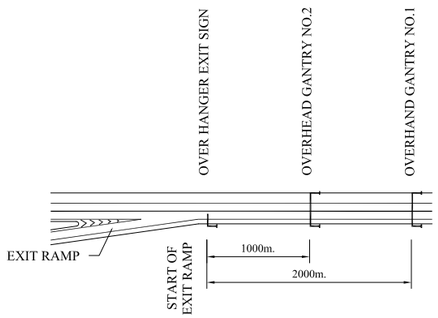
OVER HANGER EXIT SIGN
(At Start of exit ramp)



OVER HEAD EXIT SIGN
2Km/1Km Short of exit ramp



OVER HANGER EXIT SIGN



TYPICAL PLACEMENT OF OVERHEAD SIGNS AT EXIT RAMP

NOTES

1 - ALL DIMENSIONS ARE IN MILLIMETERS.
2 - GANTRY DIMENSIONS SHOWN IN THIS DRAWING ARE FOR NORMAL LOCATIONS WITH CROSS SLOPE OF 2%. EXACT DIMENSIONS SHALL BE WORKED AT KEEPING IN VIEW THE ACTUAL ROAD CROSS SECTION AT THE PROPOSED LOCATION TO ENSURE MINIMUM CLEARANCES AS SHOWN.

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:
MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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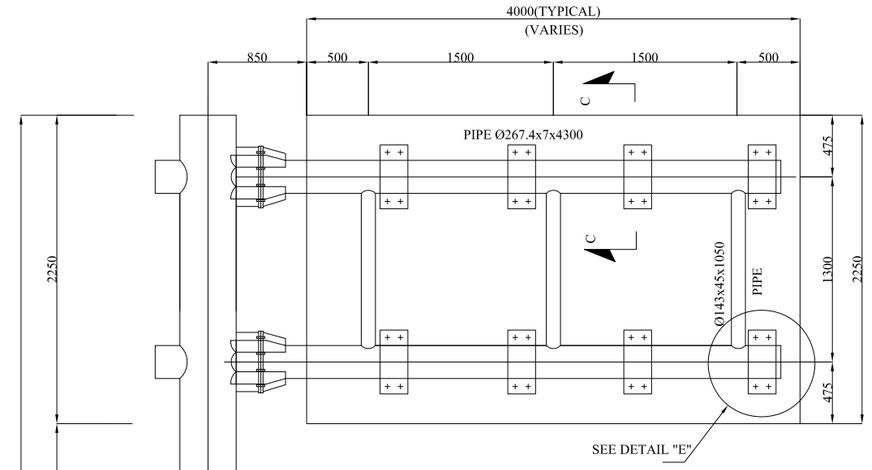
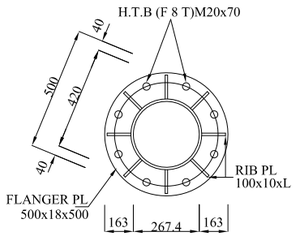
M/S LOYA ASSOCIATES
(DESIGN AND FINANCIAL
CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:
OVER HEAD HANGER
EXIT SIGN

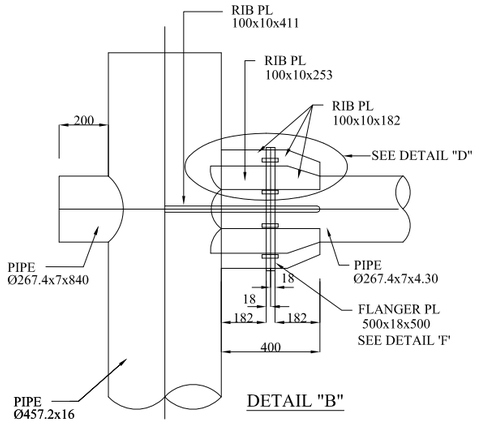
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY:	SCALE:
M. SHAKEEL	N.T.S.
CHECKED BY:	DATE:
ZAFAR ALI	SEP, 2020
APPROVED BY:	REVISION:
M. ANWAR	REV. 00

CAD FILE NAME:
LOYA-ZI/MEW/GEN/12A





DETAIL "F"
(FLANGER PLATE)



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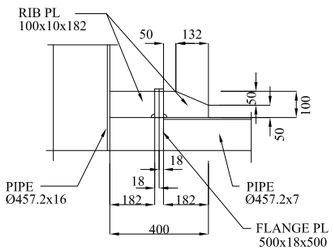

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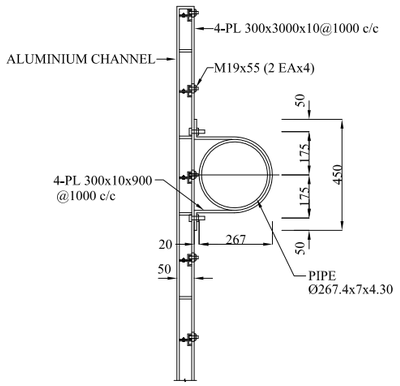
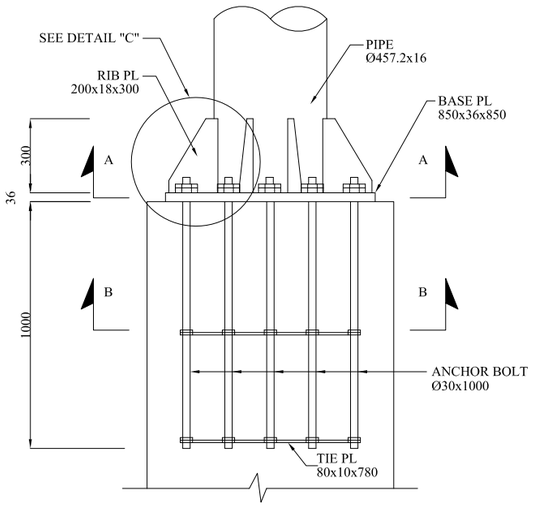
(RIB PLATE)



SECTION C-C



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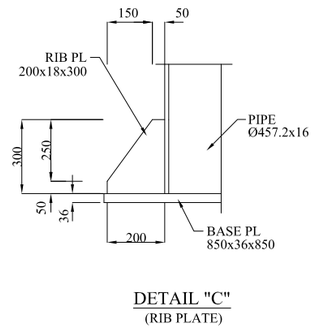

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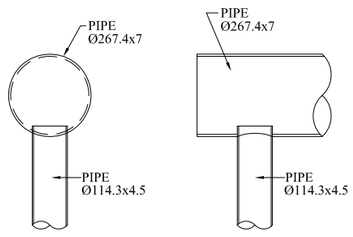

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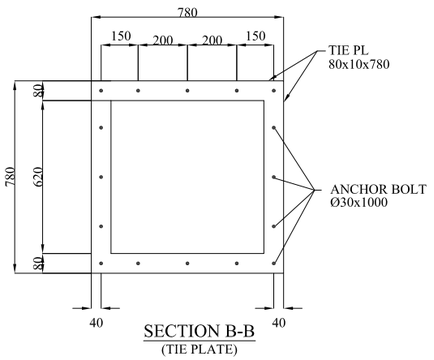
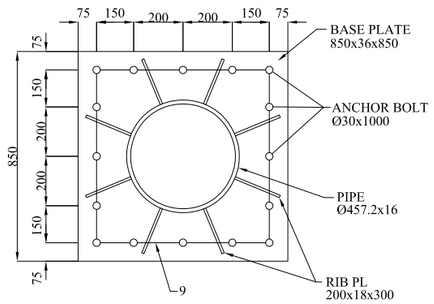


SECTION B-B
(TIE PLATE)



SECTION A-A
(BASE PLATE)

NOTES

1 - ALL DIMENSIONS ARE IN MILLIMETERS.
2 - ALL WELDS SHALL BE 6mm. THICK.
3 - CONTRACTOR MAY USE ALUMINUM PLATE (3mm. THICK) FOR SIGN FACE IN PLACE OF ALUMINUM CHANNEL WITH APPROVAL OF ENGINEER.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

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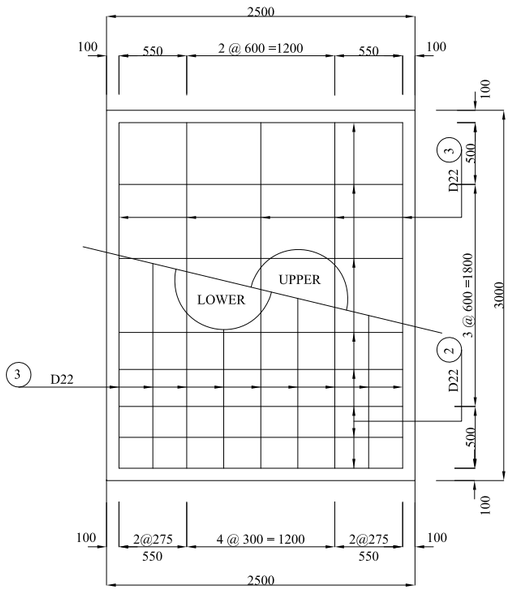
DRAWING TITLE:

OVERHEAD EXIT SIGN
STRUCTURAL DETAILS

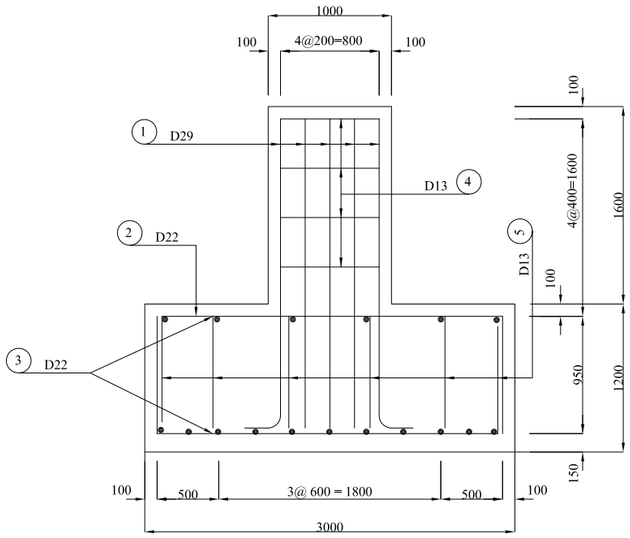
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

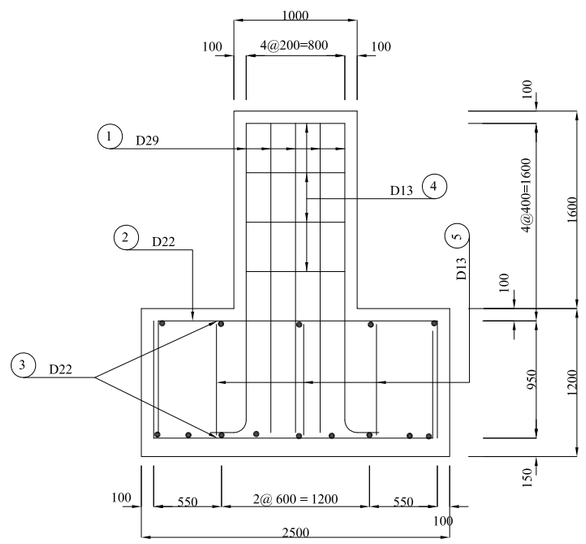
LOYA-ZI/MEW/GEN/12B



PLAN VIEW



SIDE VIEW

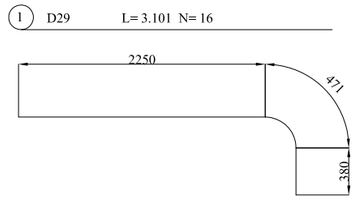


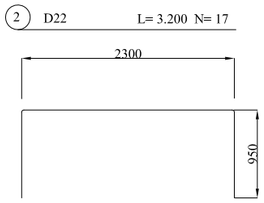
FRONT VIEW

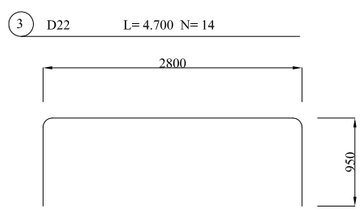
MATERIAL LIST

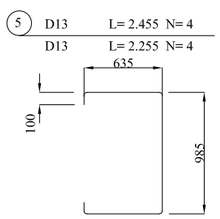
ITEM	SIZE	LENGTH	UNIT WT.	EACH	TOTAL WT	REMARKS
PIPE	Ø457.2 x 16	8.210	1,372.860	1	KG. 11,271.18	
"	Ø267.4x 10	4.300	193.500	2	387.000	
	"	840	37.800	2	75.600	
	Ø114.3x 4.5	1.050	204.179	3	KG. 40.260	
"	SUB TOTAL		13.420	4	KG. 11,773.86	
PLATE	850 x 36	850	35.325	1	KG. 204.179	BASE PL
"	500 x 18	500	8.478	2	70.650	FLG PL
	200 x 18	300		8	67.824	RIB PL
	SUB TOTAL				KG. 138.474	
"	100 x 10	411	3.226	2	6.452	RIB PL
	"	253	1.986	4	7.944	
	"	182	1.429	2	2.858	
	80 x 10	780	4.898	8	39.184	TIE PL
	SUB TOTAL				KG. 56.438	
H.T.B	M 20 x 70			8		F & T
ANCHOR BOLT	Ø30 x 1000			16		

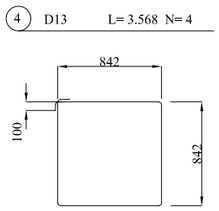
1- MATERIAL AND RE BAR LIST GIVEN ABOVE ARE FOR GUIDANCE ONLY

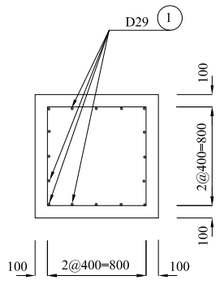












RE BAR DETAILS

RE BAR LIST

MARK	DIA	LENGTH	EACH	TOTAL LE.	UNIT WT.	TOTAL WT.	REMARKS
1	D29	3.101	16	49.616			ADD 3%
SUB TOTAL				49.416	5.040	250.065	T 0.257
2	D22	4.200	17	71.400			
3	-	4.700	14	65.800			
SUB TOTAL				13.720	3.040	417.088	T 0.429
4	D13	3.568	4	14.272			
5	D13	2.355	8	18.840			
SUB TOTAL				33.112	0.995	32.946	T 0.033
GRAND TOTAL							0.719

NOTES

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REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

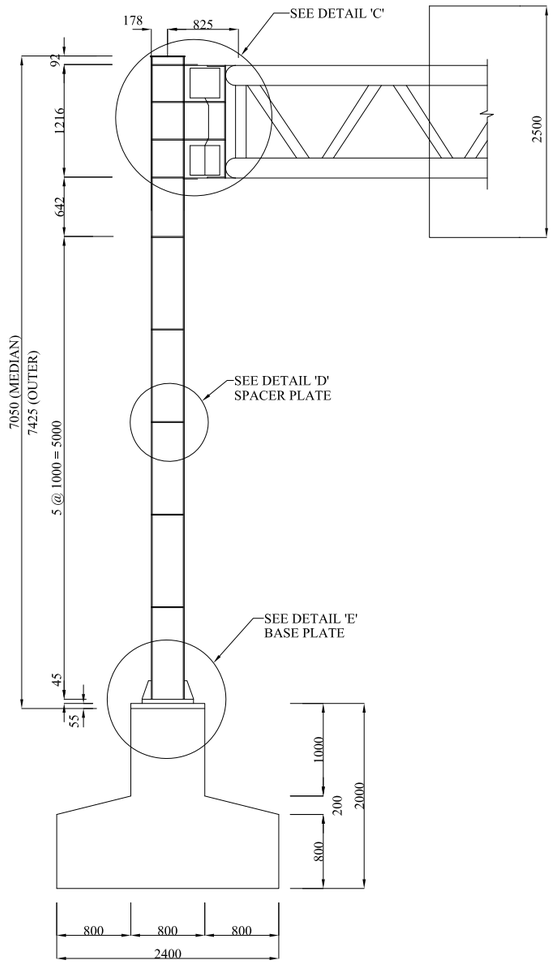
DRAWING TITLE:

OVERHEAD HANGER EXIT SIGN FOUNDATION DETAILS

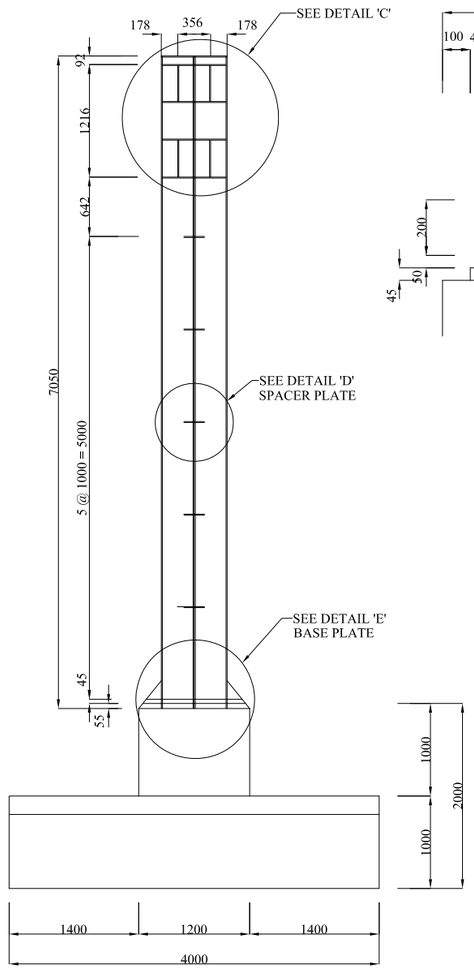
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

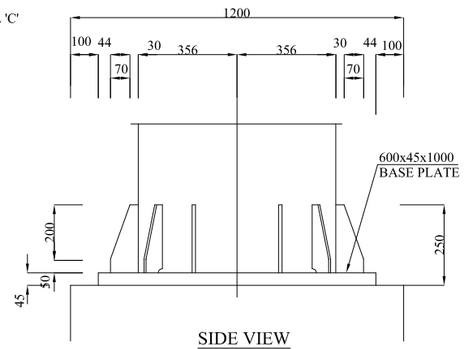
LOYA-ZI/MEW/GEN/12C



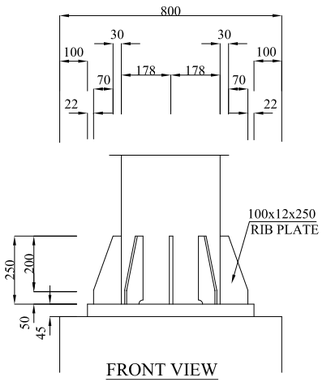
FRONT VIEW



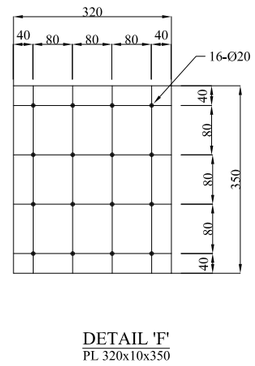
SIDE VIEW



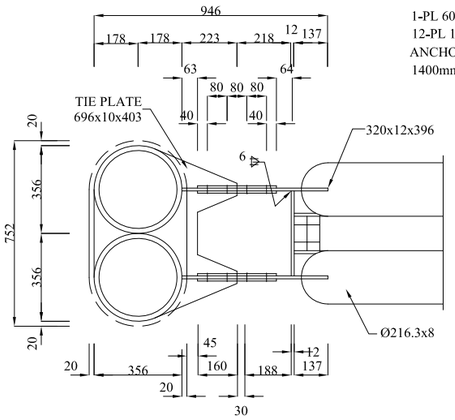
SIDE VIEW



FRONT VIEW

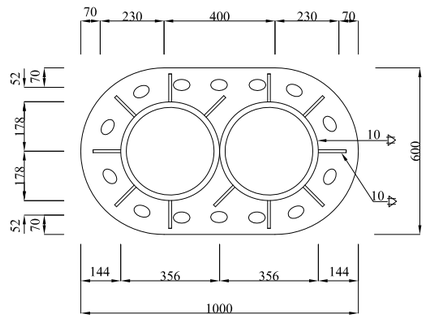


DETAIL 'F'
PL 320x10x350

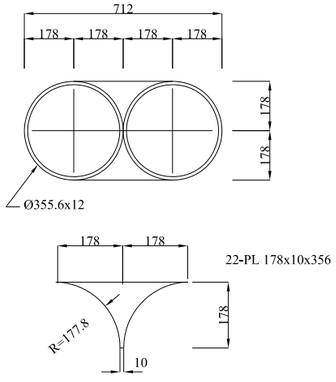


DETAIL 'C'(PLAN)

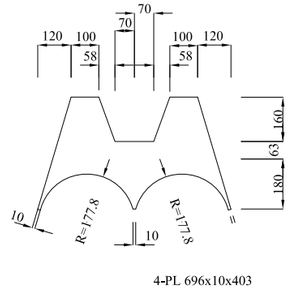
1-PL 600x45x1000
12-PL 100x12x250
ANCHOR BOLT Ø40mm.
1400mm. LONG



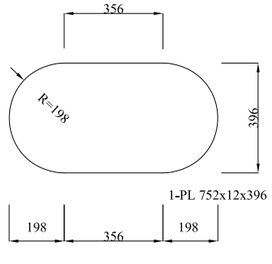
BASE PLATE



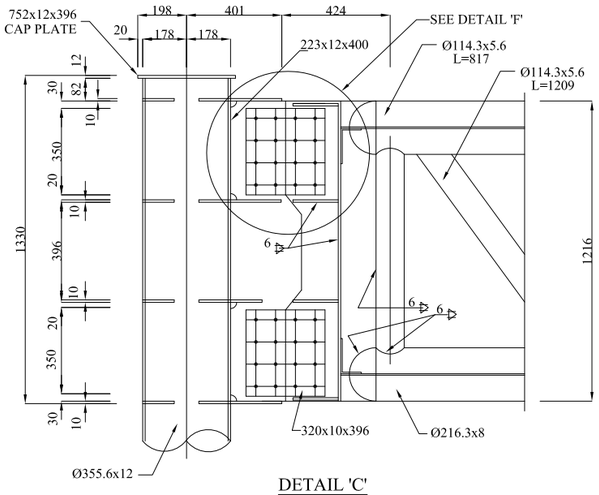
DETAIL 'D'
SPACER PLATE



TIE PLATE



CAP PLATE



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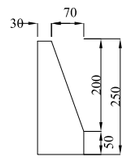

RIB DETAIL
DETAIL 'E'

DETAIL 'C' MATERIALS

TIE PLATE 4-PL 696x10x403
4-PL 223x12x400
8-PL 320x10x320
CAP 1-PL 752x12x396
4-PL 178x10x356
H.T.B FIOT - Ø20 x70 : 64EA

NOTES

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REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
1-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

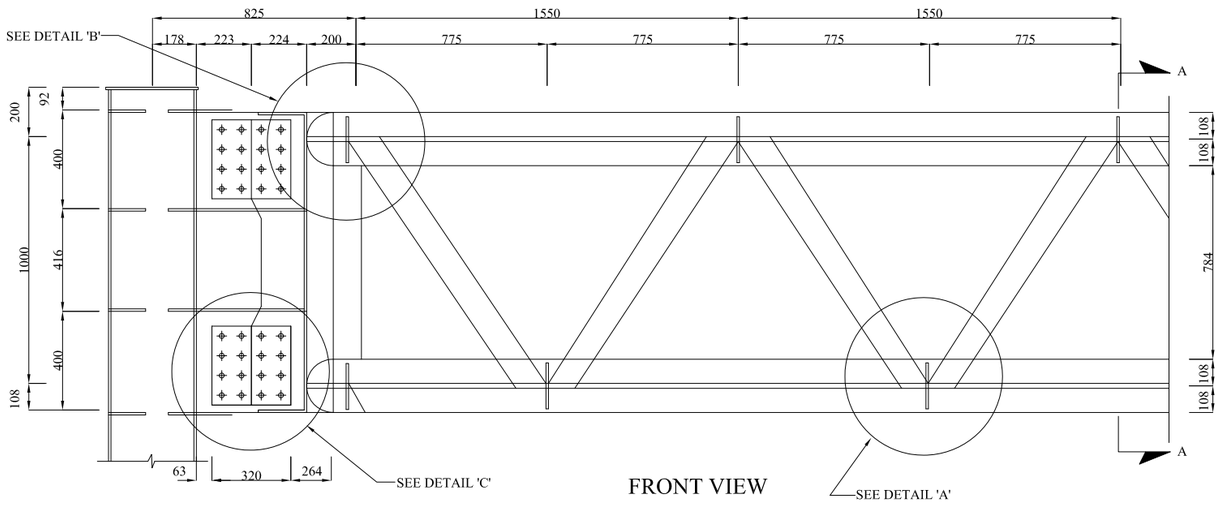
DRAWING TITLE:

GANTRY
COLUMN DETAILS

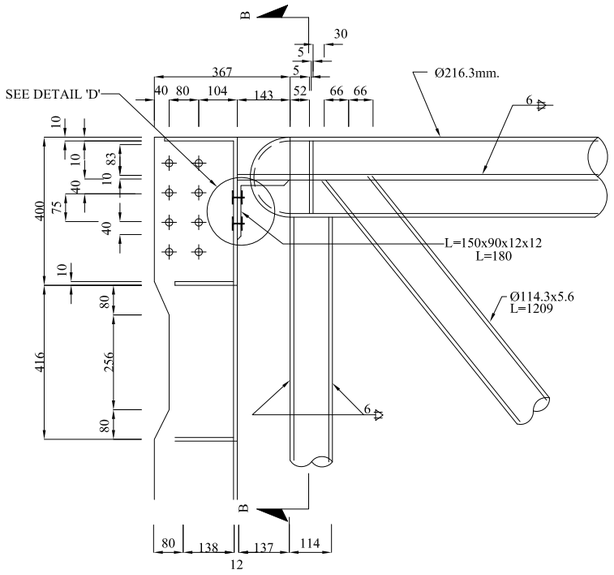
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

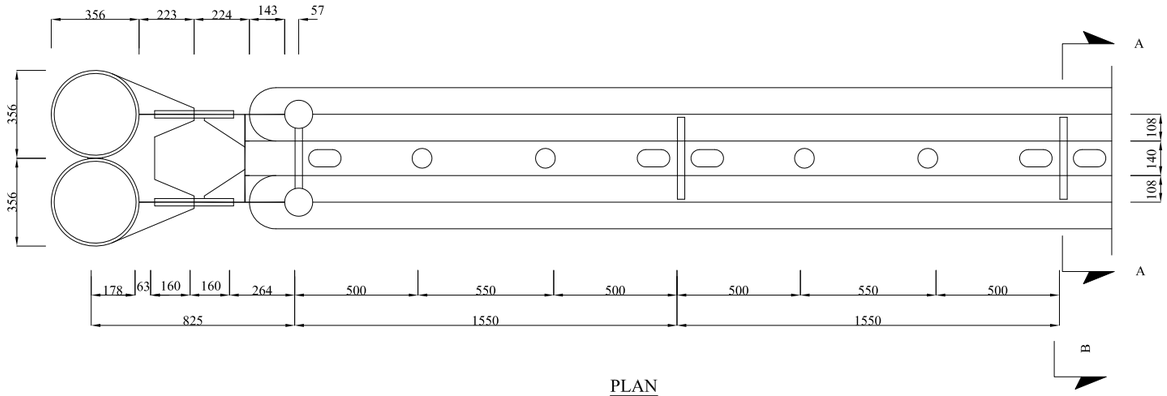
CAD FILE NAME:

LOYA-ZI/MEW/GEN/12D

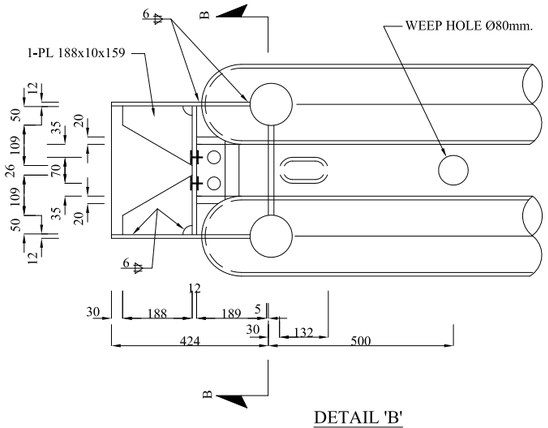


FRONT VIEW

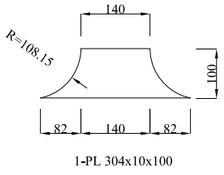




PLAN

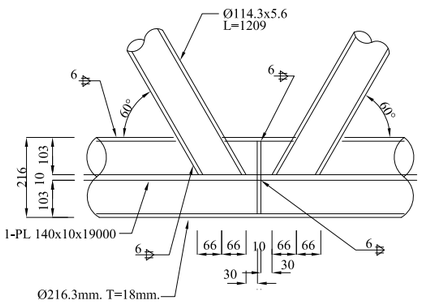


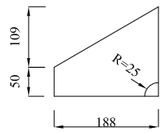
DETAIL 'B'



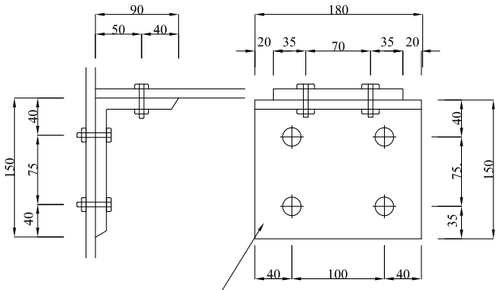
1-PL 304x10x100

RIB PL DETAIL



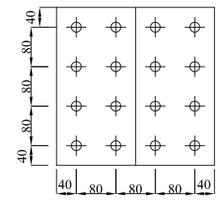


1-PL 188x10x159



DETAIL 'D'

l-150x90x12x12
l=180



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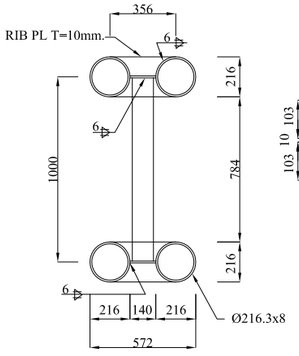
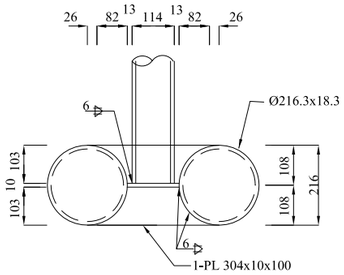


SECTION A-A



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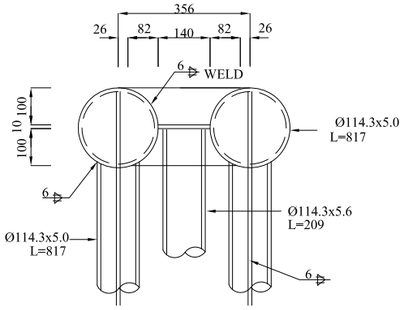

SECTION B-B

NOTES

1 - ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2 - ALL WELDS SHALL BE 6mm. THICK.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

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E.P.C. CONSULTANT :

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(DESIGN AND FINANCIAL CONSULTANT)

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3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

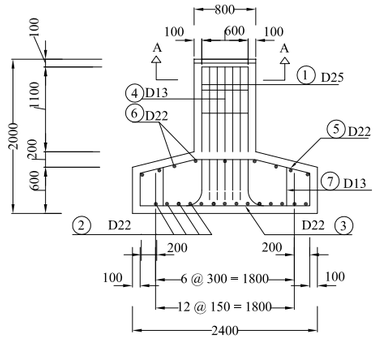
DRAWING TITLE:

GANTRY
TRUSS DETAILS

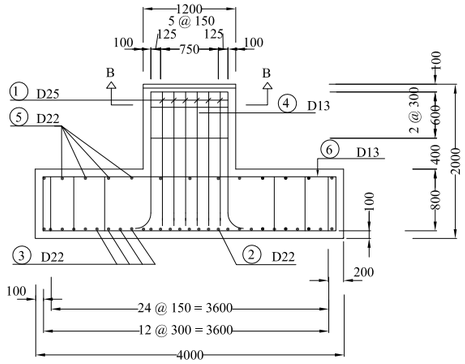
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY:	SCALE:
M. SHAKEEL	N.T.S.
CHECKED BY:	DATE:
ZAFAR ALI	SEP, 2020
APPROVED BY:	REVISION:
M. ANWAR	REV. 00

CAD FILE NAME:

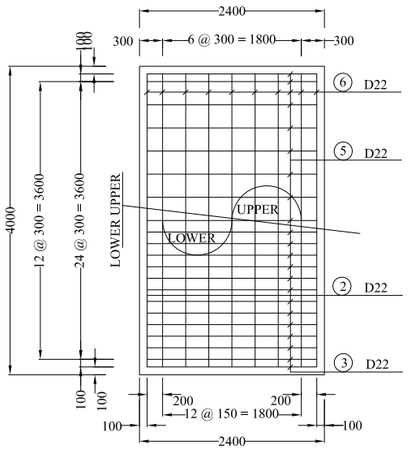
LOYA-ZI/MEW/GEN/12E



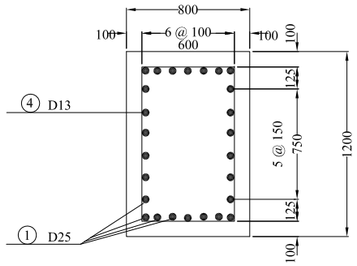
FRONT VIEW



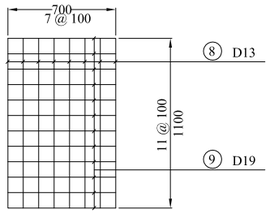
SIDE VIEW



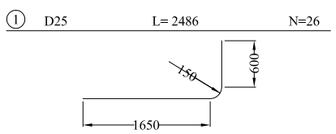
PLAN

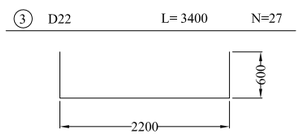


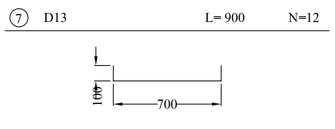
SECTION A-A

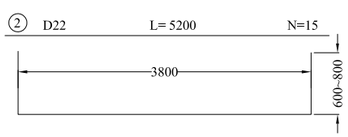


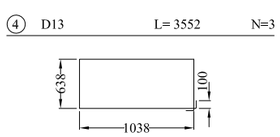
SECTION B-B

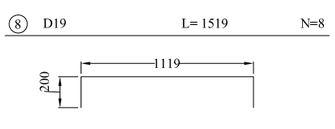


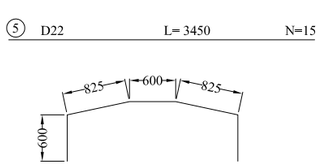


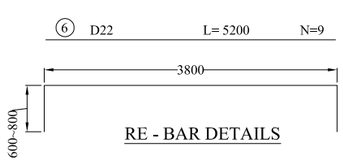


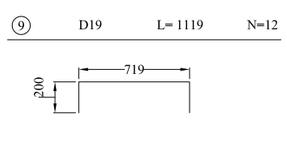












RE - BAR DETAILS

LIST OF MATERIALS (TRUSS,POST)

ITEM	DESCRIPTION	SIZE	UNIT.WT	EACH	WEIGHT (Kg)	REMARKS	RESULT
PIPE	Ø216.3 T= 8	18.930	778.023	4	3,112.092		
	Ø114.3 T= 5.6	1.209	18.135	24	435.24		
	Ø114.3 T= 5.6	817	12.255	4	49.02		
	Ø355.6 T= 12	6.950	708.90	2	1,417.80		
	Ø355.6 T= 12	7.500	765.0	2	1,530.00		
SUB TOTAL		(SS 41)			6,544.15	ADD 5%	6,871.36
PLATE	140 x 10	19.000	208.810	2	417.620		
	304 x 10	100	2.386	54	128.87		
	1.216 x 12	367	42.039	4	168.16		
	1.216 x 12	344	39.404	2	78.81		
	188 x 10	159	2.347	16	37.54		
	600 x 45	1.000	211.95	2	423.90		
	100 x 12	250	2.355	24	56.52		
	752 x 12	396	28.052	2	56.10		
	696 x 10	403	22.018	8	176.15		
	223 x 12	400	8.403	8	67.22		
	320 x 10	350	8.792	16	140.67		
	752 x 12	396	28.052	2	56.10		
	178 x 10	356	4.974	30	149.23		
SUB TOTAL		(SWS 41)			1,956.89	ADD 10%	2,152.58
ANGLE	L-150x90x12x12	180	3.87	4	15.48		
SUB TOTAL		(SS.41)			15.48	ADD 5%	16.25
BOLT	H.T.B FIOTØ20	70		152			
A. BOLT	Ø40	1.400	778.023	28	D19	D19	
TOTAL					8,516.52 8.517		9,040.19

RE - BAR LIST

NO	DIA	LENG.	EACH	TOTAL	UNIT.WT (Kg)	TOTAL WT. (Kg)	REMARKS	RESULT (Kg)
1	D25	2.486	26	64.636	3.98	257.25	ADD 3%	
SUB TOTAL						257.25	ADD 3%	264.97
2	D22	5.200	15	78.000	304	237.12		
3	=	3.400	27	91.800		297.07		
5	=	3.450	15	51.750		157.32		
6	=	5.200	9	46.800		142.27		
SUB TOTAL						815.78	ADD 3%	840.25
8	D19	1.519	8	12.152	2.25	27.34		
9	=	1.119	12	13.428		30.21		
SUB TOTAL						57.55	ADD 3%	59.28
4	D13	3.552	3	10.656	0.995	10.60		
7	=	900	12	10.800		10.75		
SUB TOTAL						21.35	ADD 3%	21.99
TOTAL			EACH			1,151.93		1,186.49

NOTES

1- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2- MATERIAL AND REBAR LISTS SHOWN ABOVE ARE FOR GUIDANCE ONLY.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

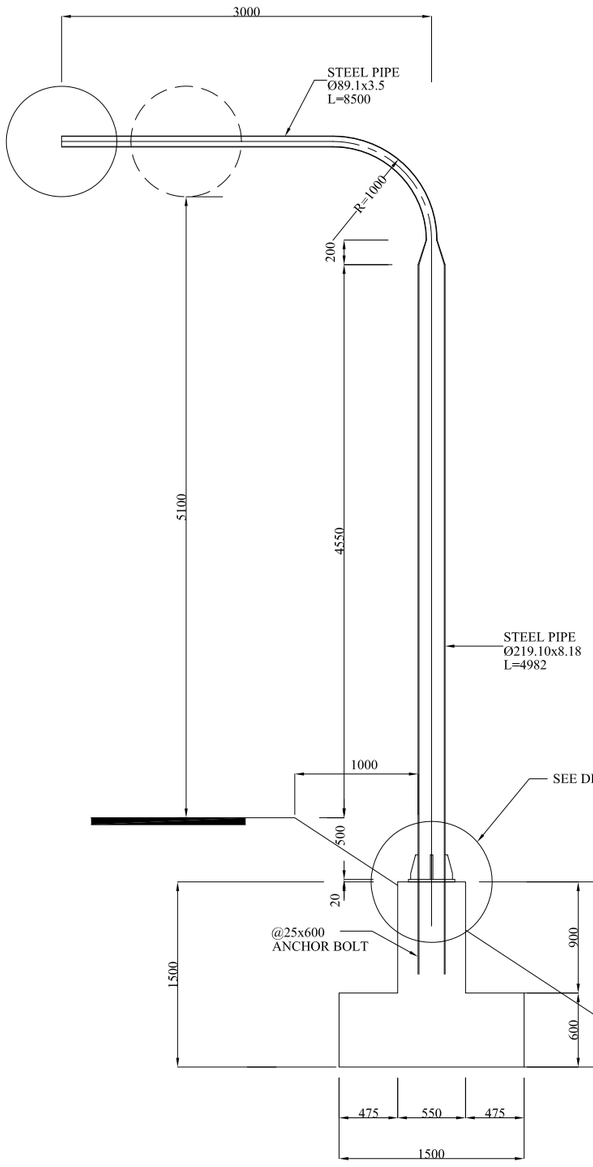
DRAWING TITLE:

GANTRY
FOUNDATION DETAILS

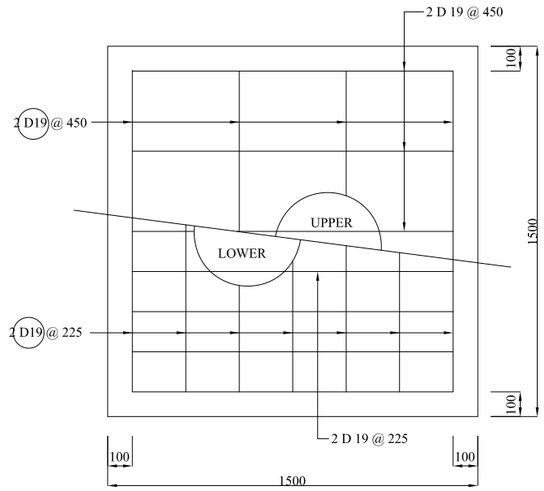
DESIGN BY: AYESHA SHABBIR	SHEET NO:
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

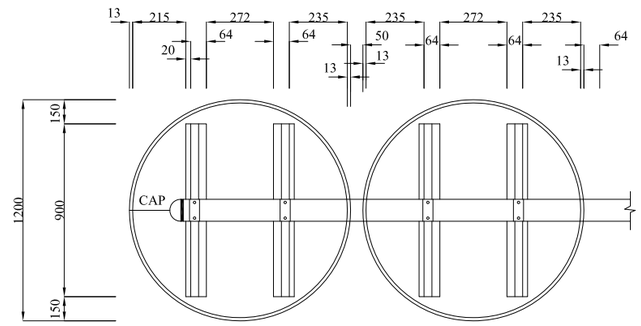
LOYA-ZI/MEW/GEN/12F



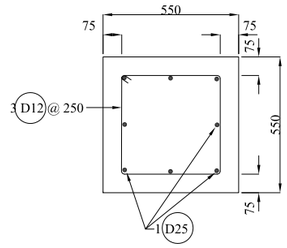
GENERAL VIEW



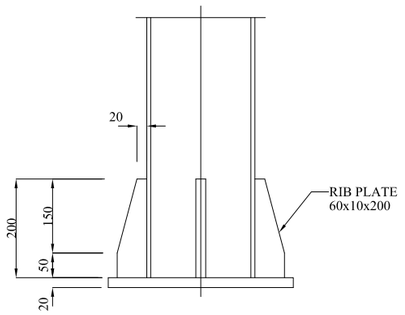
PLAN



REAR VIEW



SECTION A-A



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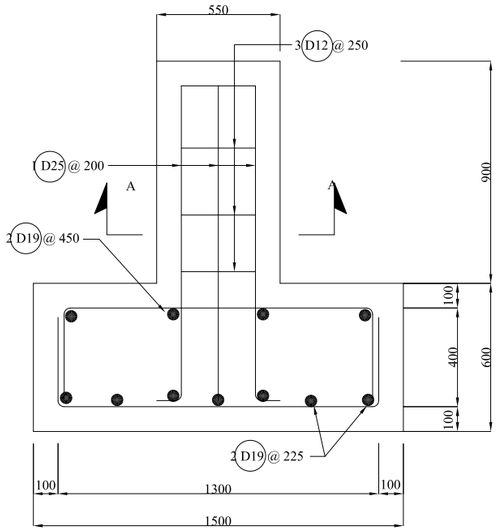
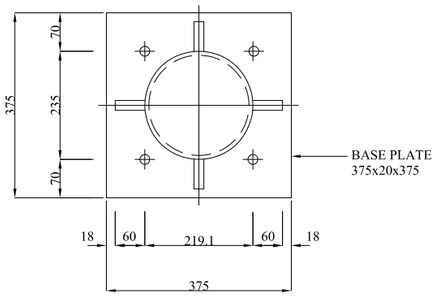


FOUNDATION



BASE PLATE

NOTES

1 - ALL DIMENSIONS ARE IN MILLIMETERS.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

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3rd Floor, Time Square Plaza,
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Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

OVERHEAD HANGER
GUIDE SIGN

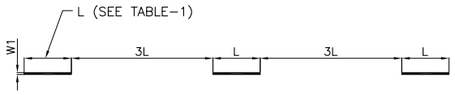
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/GEN/12G

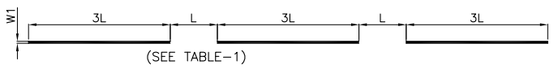
PAVEMENT MARKING LINES

FOR DIMENSIONS L & W1 TO W5, SEE TABLE–1



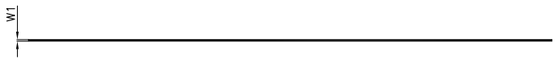
L1 - BROKEN GUIDE LINE-WHITE

AT CENTERLINE OF DIVIDED 2–LANE RAMPS AND LANE SEPARATION OF EXPRESSWAY



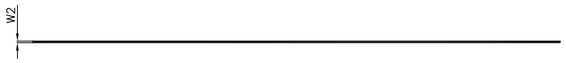
L2 -BROKEN WARNING LINE -WHITE

AT APPROACHES TO DANGER (e.g Roundabouts, T–junctions and steep slopes at ramps)



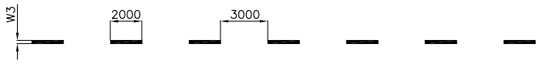
L3 - CONTINUOUS LINE - WHITE

AT NO PASSING ZONES ALONG RAMPS & OVERHEAD BRIDGES



L4 - CONTINUOUS EDGE LINE -YELLOW

AT EDGE OF PAVEMENT AT ALL LOCATIONS



L5 - DASHED LINE - WHITE

AT SEPARATION OF THROUGH LANES FROM ACCELERATION LANE



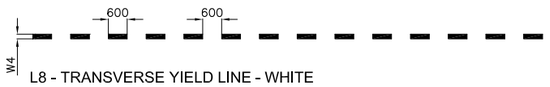
L6 - DOTTED LINE - WHITE

FOR DEFINING VEHICLE PATHS WITHIN INTERSECTIONS AT RAMPS



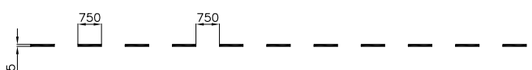
L7 - STOP LINE - WHITE

AT INTERSECTIONS ACROSS PAVEMENT AT RAMPS



L8 - TRANSVERSE YIELD LINE - WHITE

AT INTERSECTIONS ACROSS PAVEMENT IN THE SAME POSITION AS L7 LINE TO INDICATE GIVE WAY

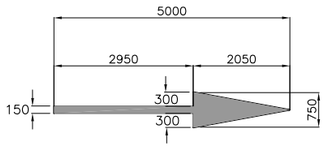


L9 - DOTTED LINE - YELLOW

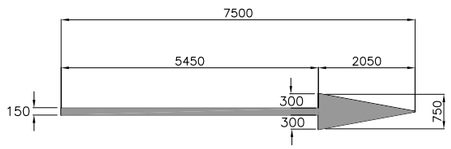
FOR EDGE LINE WHERE PARKING BAYS ARE PROVIDED OUTSIDE THE LANE

LANE SELECTION ARROWS - WHITE

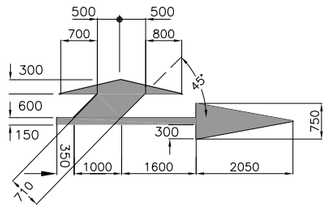
(ACCESS RAMPS)

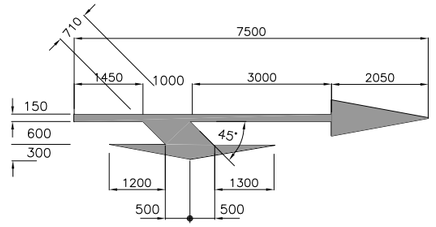


(EXPRESSWAY)

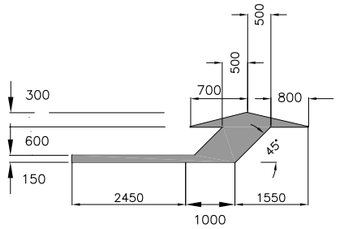


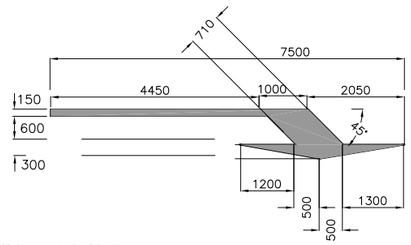
ARROWS TYPE-I (STRAIGHT)





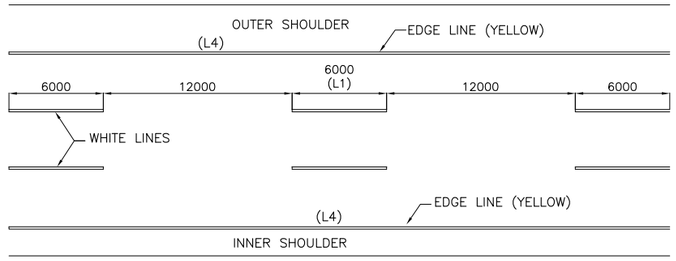
ARROWS TYPE-II (COMBINED)





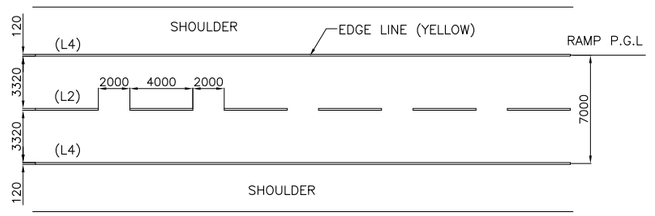
ARROWS TYPE-III (DEFLECTION)

TYPICAL MARKING AT EXPRESSWAY



TYPICAL MARKING AT TWO LANE

RAMP (AT APPROACHES TO HAZARDS)



TYPICAL MARKING AT ONE WAY

RAMPS (SINGLE LANE)

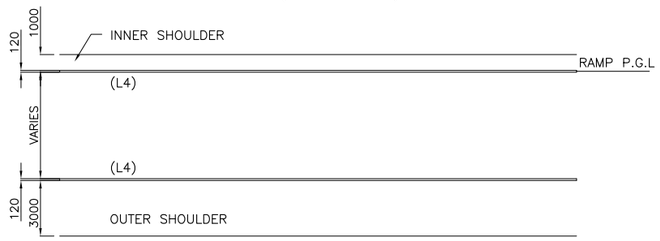


TABLE - 1

ROADWAY TYPE	L (mm)	W1	W2	W3	W4	W5
SERVICE ROAD	2000	100	100	100	300	100
FLYOVER/ RAMPS	4000	120	120	150	300	100
EXPRESSWAY	6000	120	150	450	–	–

NOTE :-

1– ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.

NOTES

ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

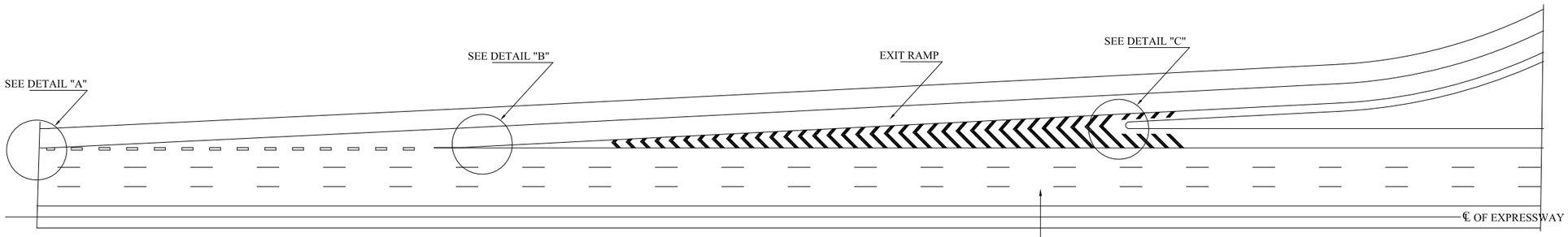
DRAWING TITLE:

PAVEMENT MARKING - 1

DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/GEN/13



DECELERATION LANE
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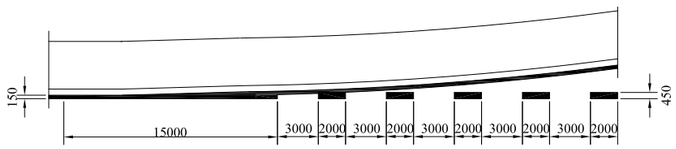

DETAIL "A"
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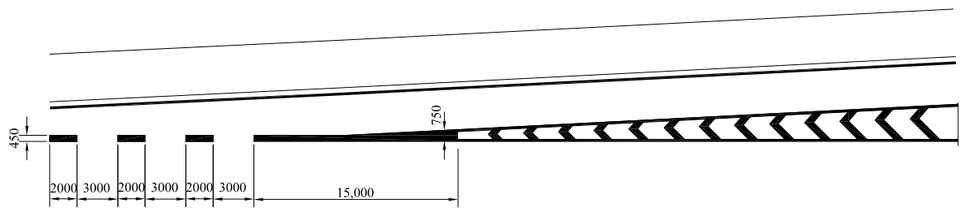

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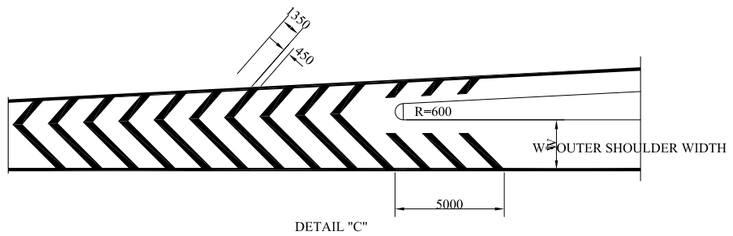
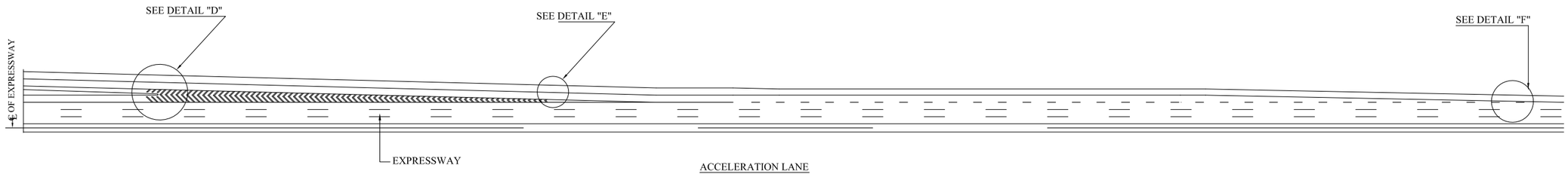


DETAIL "C"



ACCELERATION LANE
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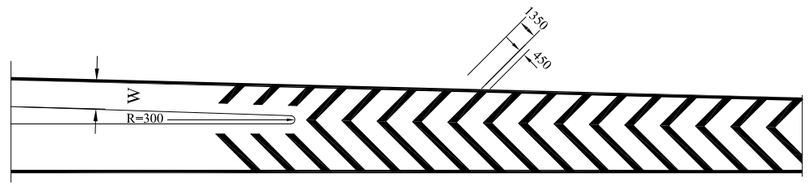

DETAIL "D"
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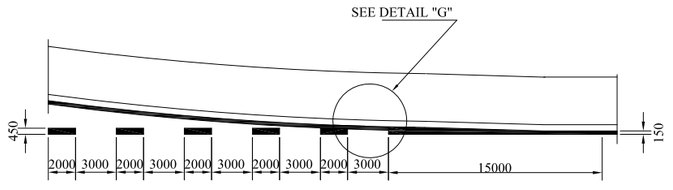

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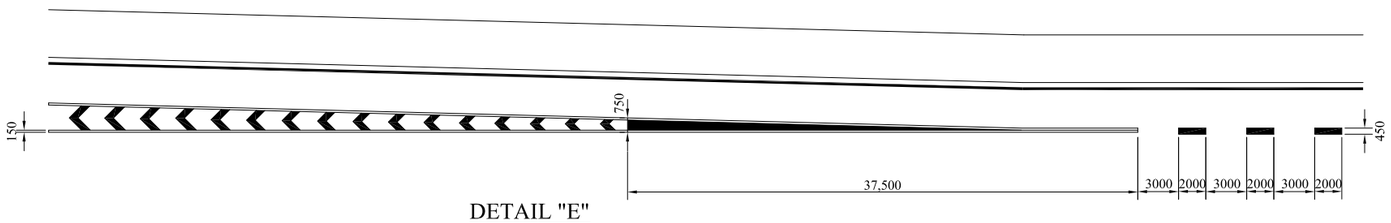

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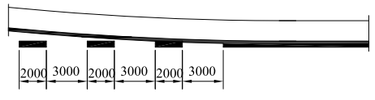


DETAIL "G"
SCALE = 1:200

NOTES

ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
1-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

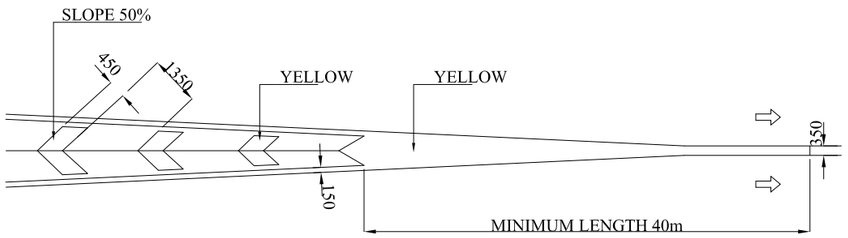
DRAWING TITLE:

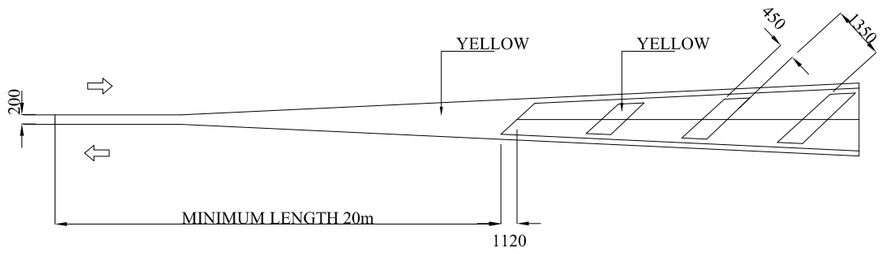
PAVEMENT MARKING - 2

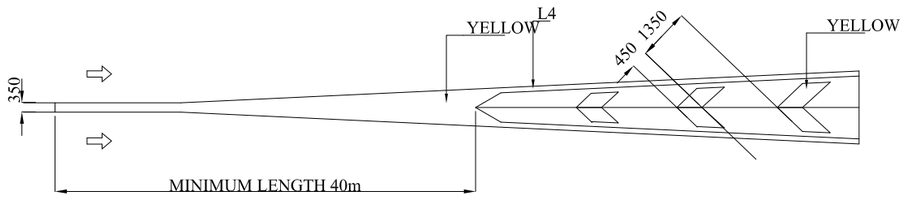
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY:	SCALE:
M. SHAKEEL	N.T.S.
CHECKED BY:	DATE:
ZAFAR ALI	SEP, 2020
APPROVED BY:	REVISION:
M. ANWAR	REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/GEN/13A







ROAD MARKINGS FOR INTERCHANGES

SCALE = 1:200

NOTES

ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES
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ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

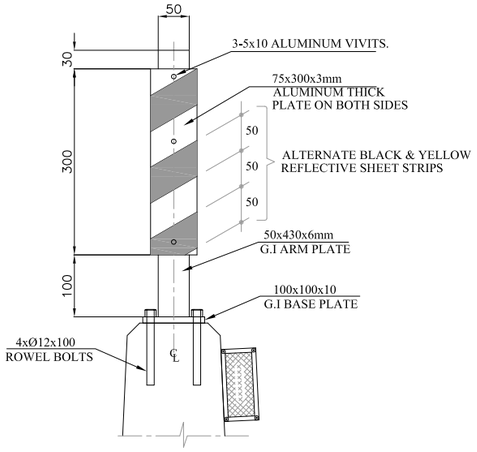
DRAWING TITLE:

PAVEMENT MARKING - 3

DESIGN BY: AYESHA SHABBIR	SHEET NO:
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/GEN/13B



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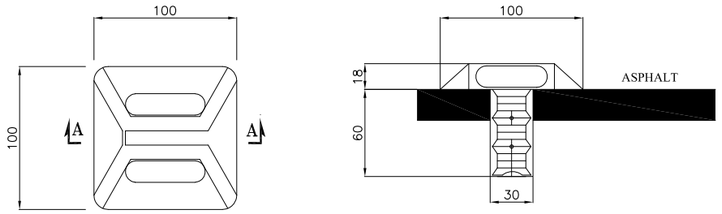
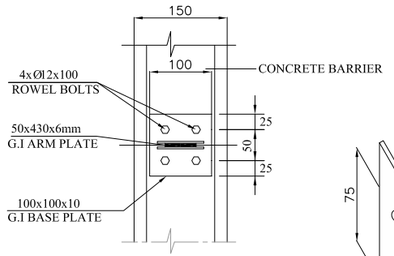


PLAN

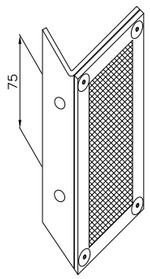
SECTION A-A

REFLECTORISED PAVEMENT STUD
(RAISED PROFILE TYPE)

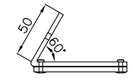


PLAN

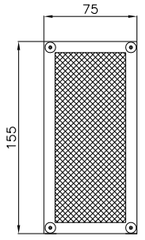
CURVE DELINEATOR TYPE-2
(RIGID TYPE)



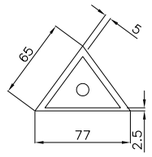
ISOMETRIC VIEW



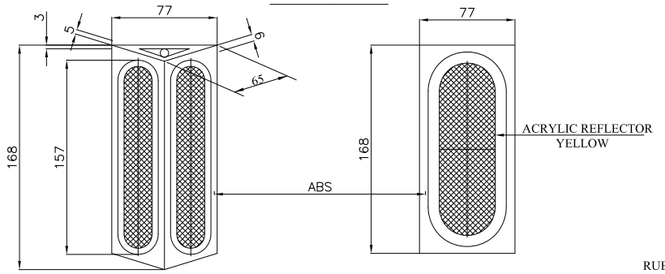
TOP VIEW



FRONT VIEW



PLAN VIEW



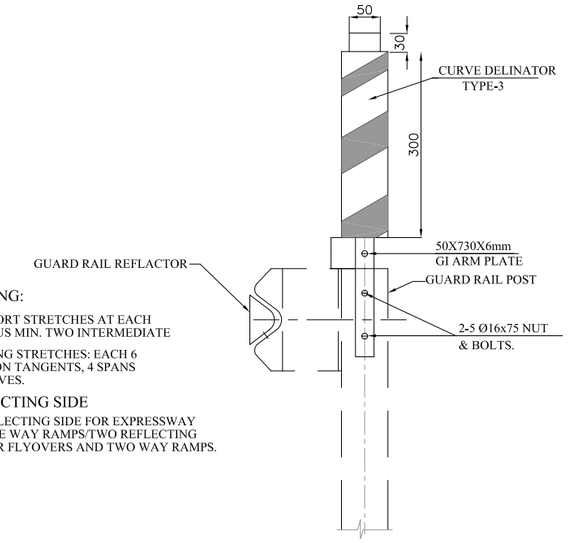
FRONT VIEW

PLAN VIEW

CONCRETE BARRIER REFLECTOR
(TYPE-1)

(TO BE FIXED WITH CONCRETE BARRIER USE 2xØ10x75 ROWEL BOLTS)

CONCRETE BARRIER REFLECTOR
(TYPE-2)



SPACING:

FOR SHORT STRETCHES AT EACH END PLUS MIN. TWO INTERMEDIATE

FOR LONG STRETCHES: EACH 6 SPANS ON TANGENTS, 4 SPANS ON CURVES.

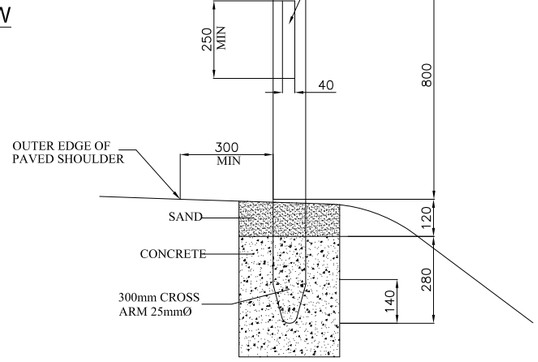
REFLECTING SIDE

-ONE REFLECTING SIDE FOR EXPRESSWAY AND ONE WAY RAMPS/TWO REFLECTING SIDE FOR FLYOVERS AND TWO WAY RAMPS.

GUARD RAIL REFLECTOR

TYPICAL DELINEATOR INSTALATION
ON HORIZONTAL CURVES

CURVE RADIUS R (m)	SPACING ON CURVE (S) (m)
500 & ABOVE	50
300	30
200	20
100	15
50	10
25	8



CURVE DELINEATOR (TYPE-1)
(FLEXIBLE TYPE)

(ALONG SHOULDER EDGES WHEN NO RAIL OR BARRIER IS FIXED)

NOTES

1 - ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.

2 - DELINEATOR TYPE-1 SHALL BE FIXED AT OUTER EDGE OF C/WAY WHERE NO RAIL OR BARRIER IS FIXED.

3 - DELINEATORS TYPE-2 SHALL BE FIXED AT MEDIAN BARRIER ALONG CURVES AT BARRIER ALONG BRIDGES INCLUDING 100m APPROACH AND AT OTHER HAZARDUOUS LOCATIONS AS DIRECTED AT EACH END BY THE ENGINEER.

4 - SPACING OF DELINEATOR TYPE-2 SHALL BE SAME AS THAT TYPE-1

NOTES

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REV.	REVISION/ISSUE	DATE

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MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

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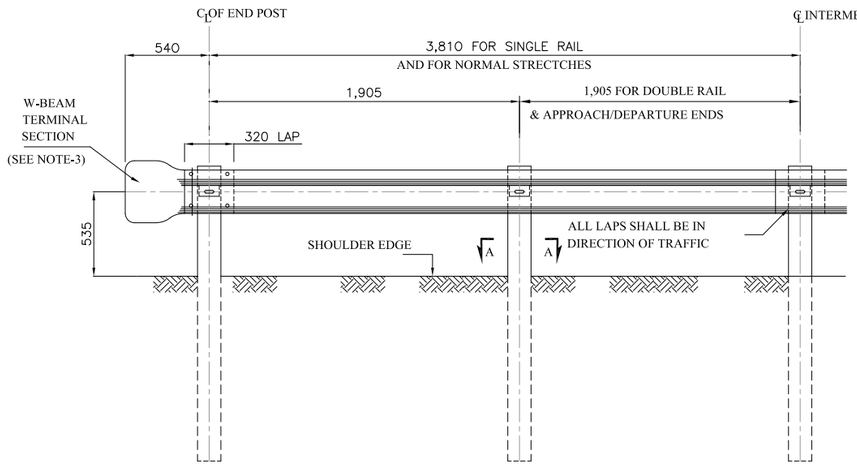
DRAWING TITLE:

REFLECTORS, STUDS AND DELINEATORS

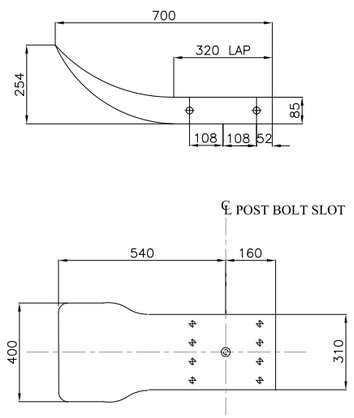
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

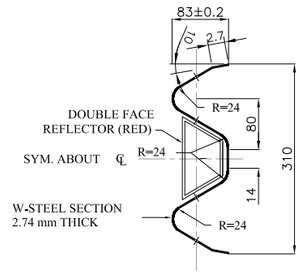
LOYA-ZI/MEW/GEN/14



TYPICAL ELEVATION AT DEPARTURE END

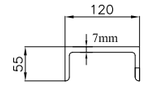


W-BEAM TERMINAL SECTION (AT DEPARTURE END)

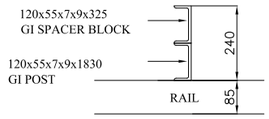


SECTION THROUGH W BEAM RAIL

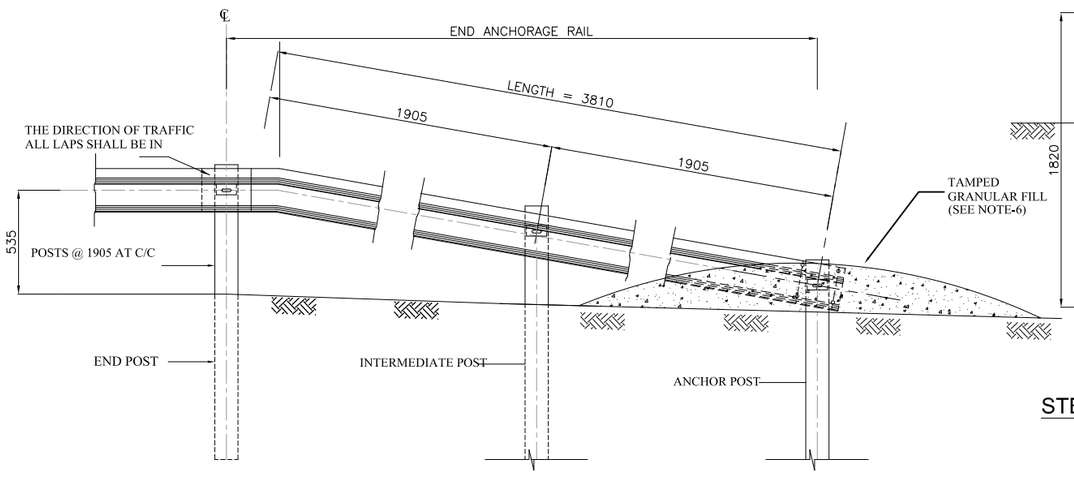
(TYPE-1, CLASS B)



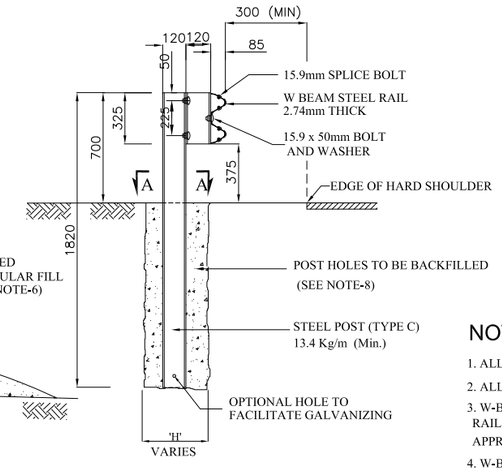
SECTION A-A



DETAIL - B



TYPICAL END RAIL ANCHORAGE AT APPROACH END

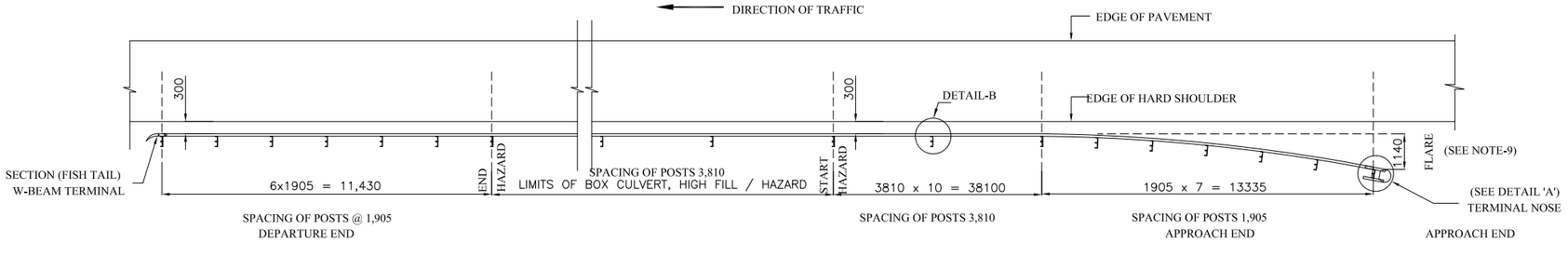


STEEL POST FOR GUARD RAIL

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS. UNLESS NOTED OTHERWISE.
2. ALL LAPS SHALL BE IN THE DIRECTION OF TRAFFIC.
3. W-BEAM TERMINAL SECTIONS SHALL BE USED IN PLACE OF END ANCHORAGE RAIL AT THE DEPARTURE END ONLY OR AT OTHER RESTRICTED LOCATIONS AS APPROVED BY THE ENGINEER.
4. W-BEAM RAIL SECTION SHALL COMFORM TO AASHTO M-180 AND SHALL BE TYPE-1, CLASS B, WHEREAS POST SHALL BE TYPE 'C' (STRONG POST).
5. WHERE THE GUARDRAIL HAS TO FOLLOW A CURVE OF LESS THAN 45m RADIUS, THE BEAM SHALL BE CURVED TO SUIT, BY THE BEAM MANUFACTURER.
6. THE HOLES FOR ANCHORAGE POSTS SHALL BE BACKFILLED WITH WELL COMPACTED GRANULAR MATERIAL. THE SPACE INSIDE THE TERMINAL NOSE SHALL BE FILLED WITH CONCRETE.
7. CONTRACTOR SHALL PREPARE DRAWINGS SHOWING LOCATION, ELEVATIONS AND SPACING OF POSTS AT EACH CULVERT/HIGH FILL LOCATION AND SHALL OBTAIN ENGINEER'S APPROVAL.
8. BACKFILLING OF THE POST HOLES WILL BE CARRIED OUT AS FOLLOWS:
   - IN CASE OF ROCK, CORED HOLES-250 DIA (AS MADE) WILL BE BACKFILLED WITH LEAN CONCRETE.
   - IN CASE OF STRATA OTHER THAN ROCK, HOLES-300 DIA (AS MADE) WILL BE BACKFILLED WITH LEAN CONCRETE OR THE POSTS MAY BE HAMMERED IN PLACE AS APPROVED BY THE ENGINEER. NO EXTRA PAYMENT SHALL BE MADE TO THE CONTRACTOR FOR CORING AND OR CONCRETEING FOR POST FIXATION.
9. EXISTING EMBANKMENT MAY BE WIDENED, WHERE NECESSARY, TO ACCOMODATE GUARD RAIL FLARE AT APPROACH END.

GUARD RAIL FOR BOX CULVERTS, HIGH FILL (>3m) OR HAZARD



NOTES

ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

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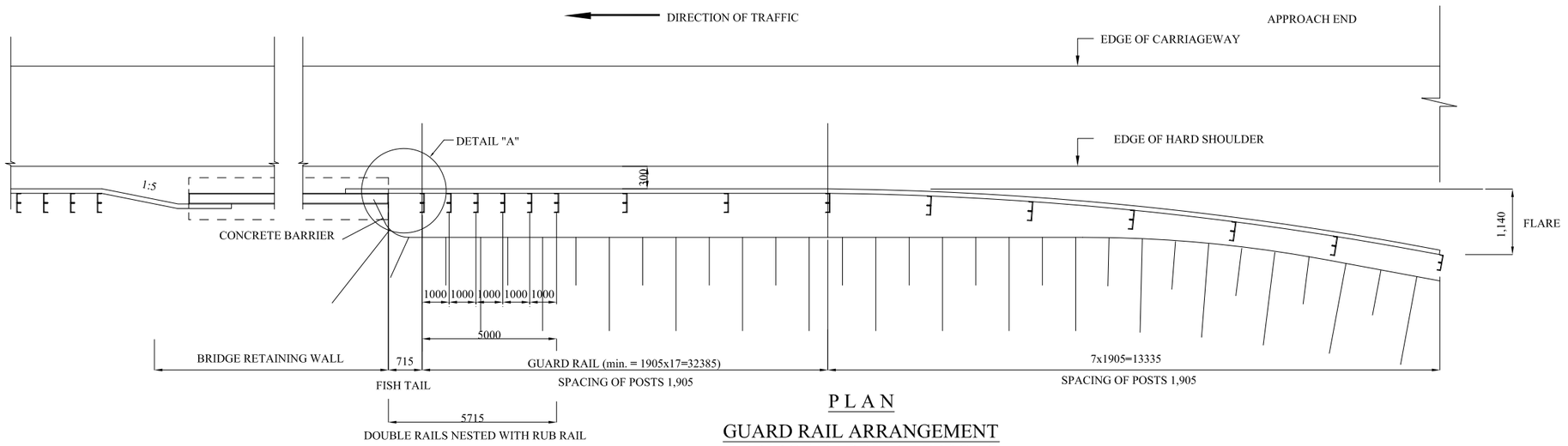
DRAWING TITLE:

GUARD RAIL - 1

DESIGN BY: AYESHA SHABBIR	SHEET NO:
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/GEN/15



P L A N

GUARD RAIL ARRANGEMENT AT BRIDGE/BARRIER APPROACH

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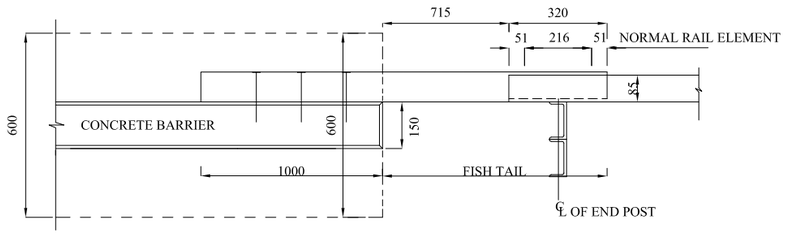
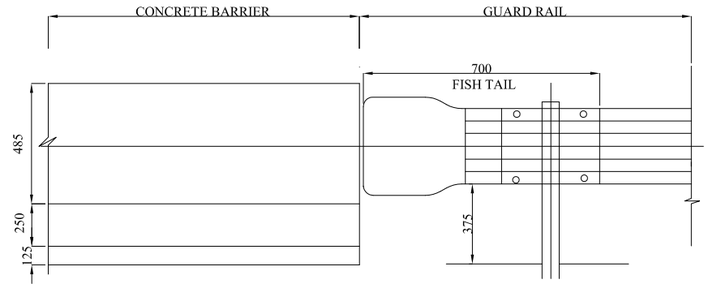


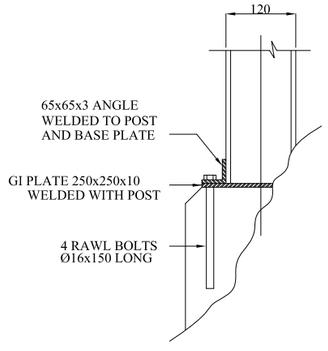
DETAIL "A"

SCALE = 1:200



ELEVATION

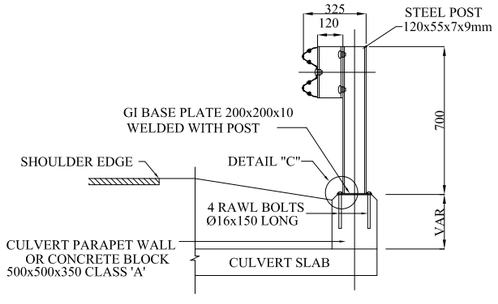
SCALE = 1:200



DETAIL 'C'

SCALE = 1:200

DETAIL OF GUARDRAIL JOINING WITH CONCRETE BARRIER

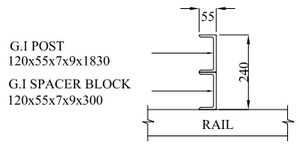


STEEL POST FIXATION AT STRUCTURES/CONCRETE BLOCK

SCALE = 1:200

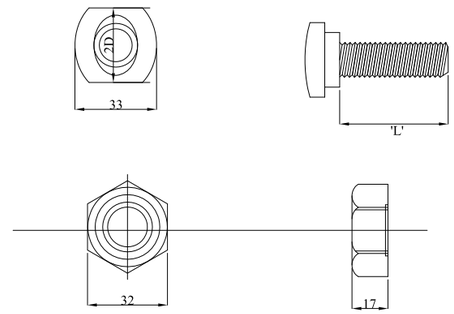
TABLE No. 1

L (mm)	THREAD LENGTH (mm)
35	FULL THREAD
50	45mm THREAD
255	100mm THREAD
460	150mm THREAD



DETAIL "B"

SCALE = 1:200



POST OR SPLICE BOLT AND NUT

SCALE = 1:200

NOTES

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REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

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Ph: 051-4938213-4, FAX: 051-4938215

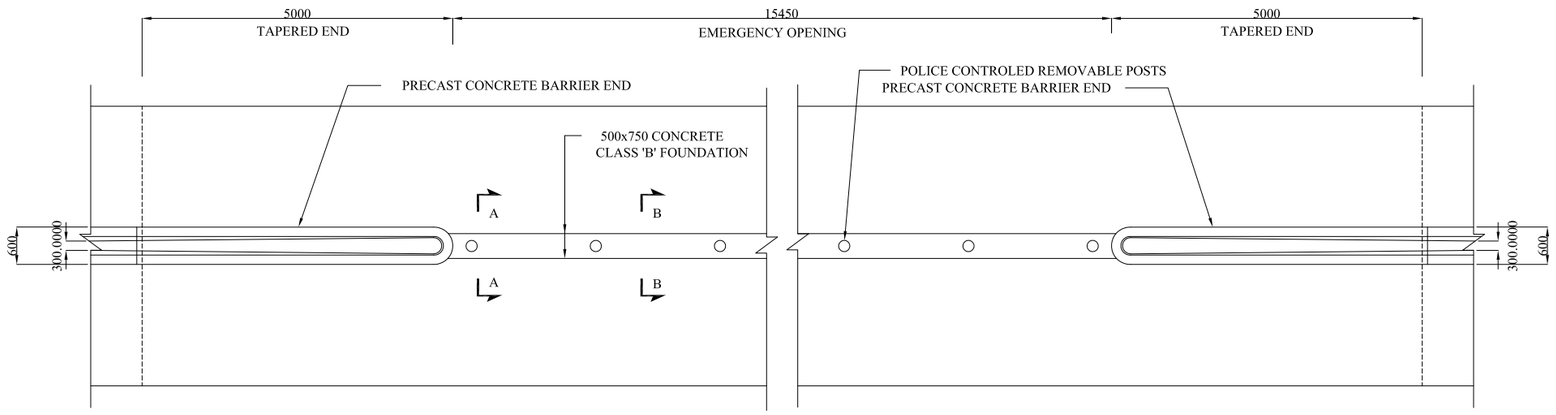
DRAWING TITLE:

GUARD RAIL - 2

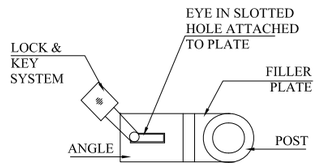
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

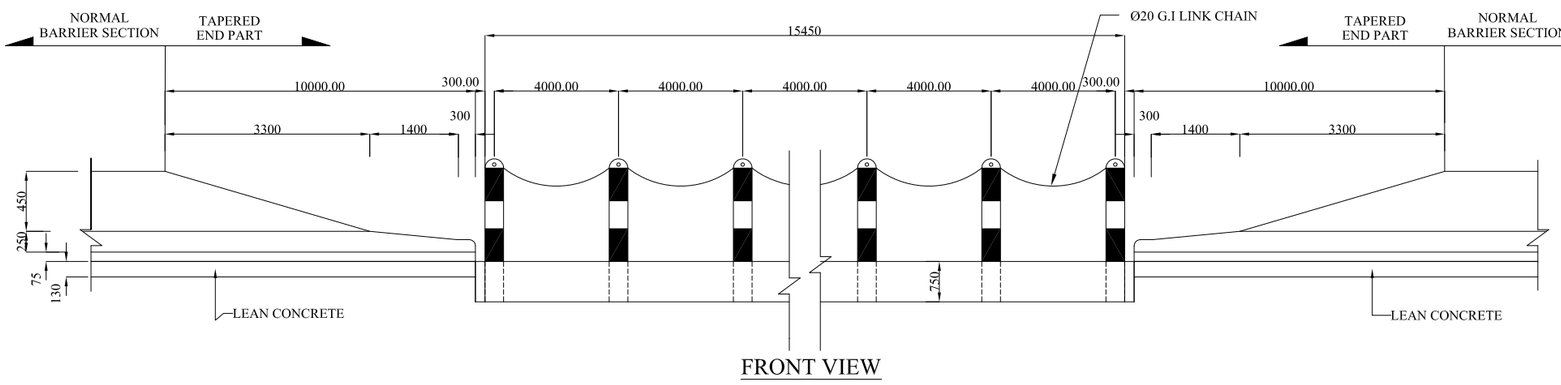
LOYA-ZI/MEW/GEN/15A



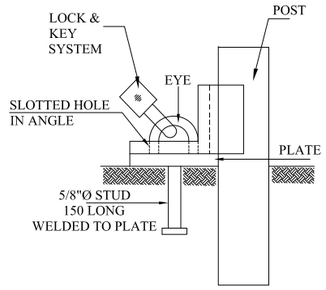
PLAN
MEDIAN OPENING
SCALE = 1:200



PLAN
DETAIL 'B'
SCALE = 1:200



FRONT VIEW
SCALE = 1:200



FRONT VIEW
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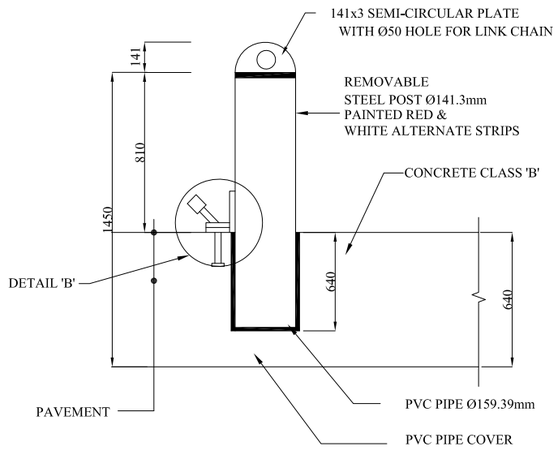
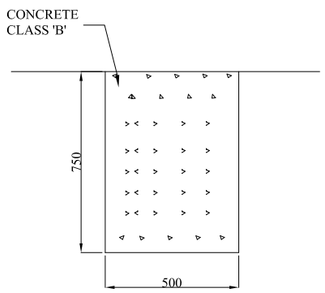


SECTION A-A
SCALE = 1:200



SECTION B-B
SCALE = 1:200

LOCATION OF
MEDIAN BARRIER OPENINGS

TABLE 1
(STATION IN Kms)

NO.	STATION
01	140+000

NOTES

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MALIR EXPRESSWAY PROJECT

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DEPARTMENT
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E.P.C. CONCESSIONAIRE:

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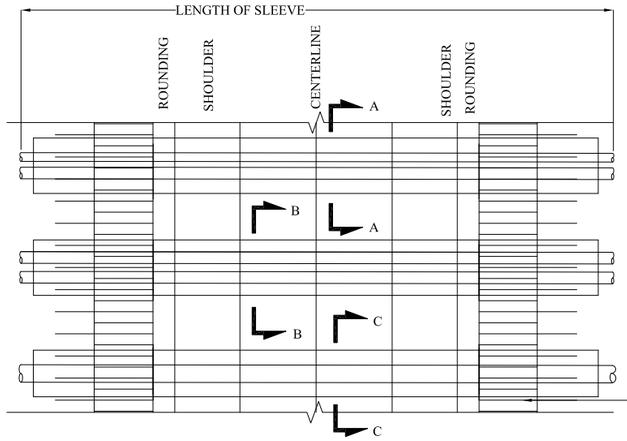
DRAWING TITLE:

MEDIAN BARRIER
OPENING DETAILS

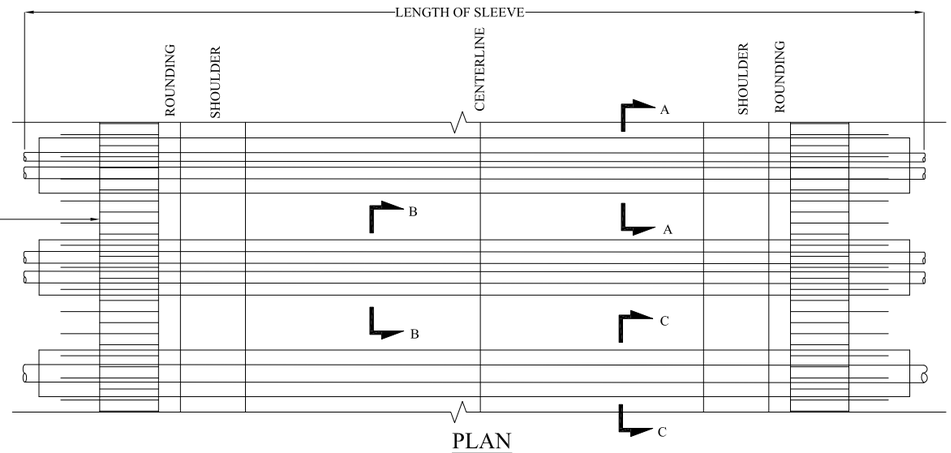
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/GEN/16



PLAN
SCALE = 1:200



TOE OF EMBANKMENT

PLAN
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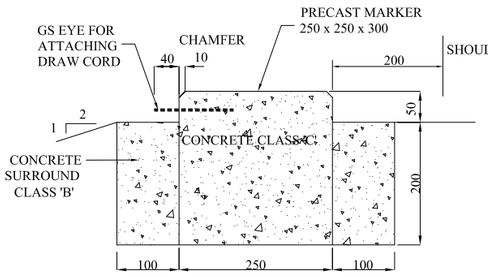

ELEVATION
PRECAST DUCT MARKER
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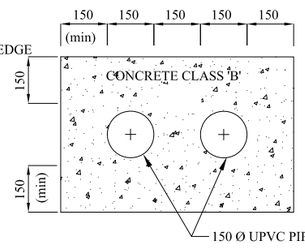
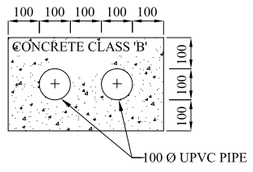
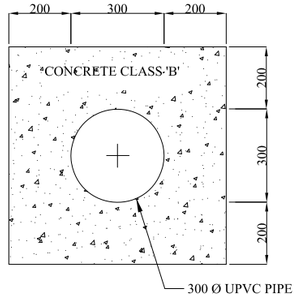


SECTION A-A
(DUCTS FOR
ELECTRICAL CABLES)
SCALE = 1:200



SECTION B-B
(DUCTS FOR
TELEPHONE CABLES TWO WAY)
SCALE = 1:200



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(DUCTS FOR WATER LINES)
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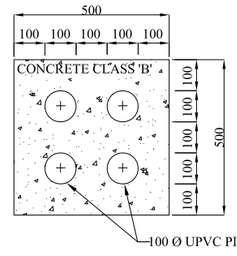

SECTION B-B
(DUCTS FOR
TELEPHONE CABLES 4 WAY)
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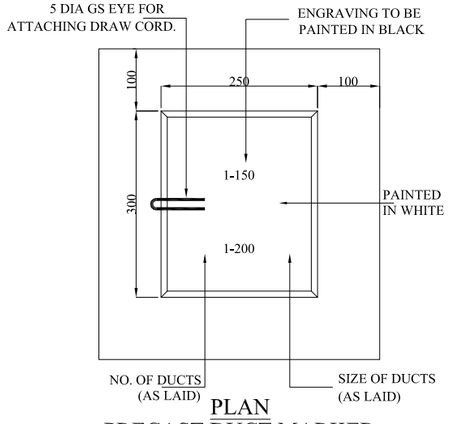
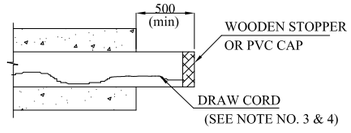


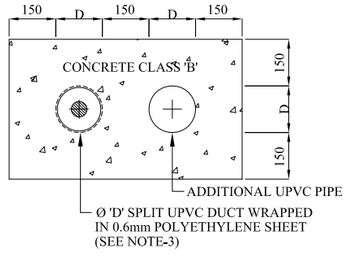
PLAN
PRECAST DUCT MARKER
SCALE = 1:200



DETAIL - A

DUCT TYPE	NO.	DIA	CONCRETE (M^3)
ELECTRICAL (2 WAY)	2	150	0.300
TELEPHONE(2 WAY)	2	100	0.135
TELEPHONE(4 WAY)	4	100	0.219
WATER (1 WAY)	1	300	0.419

MATERIAL LIST
SCALE = 1:200



DUCT FOR PROTECTION OF
EXISTING SERVICES
SCALE = 1:200

NOTES

ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

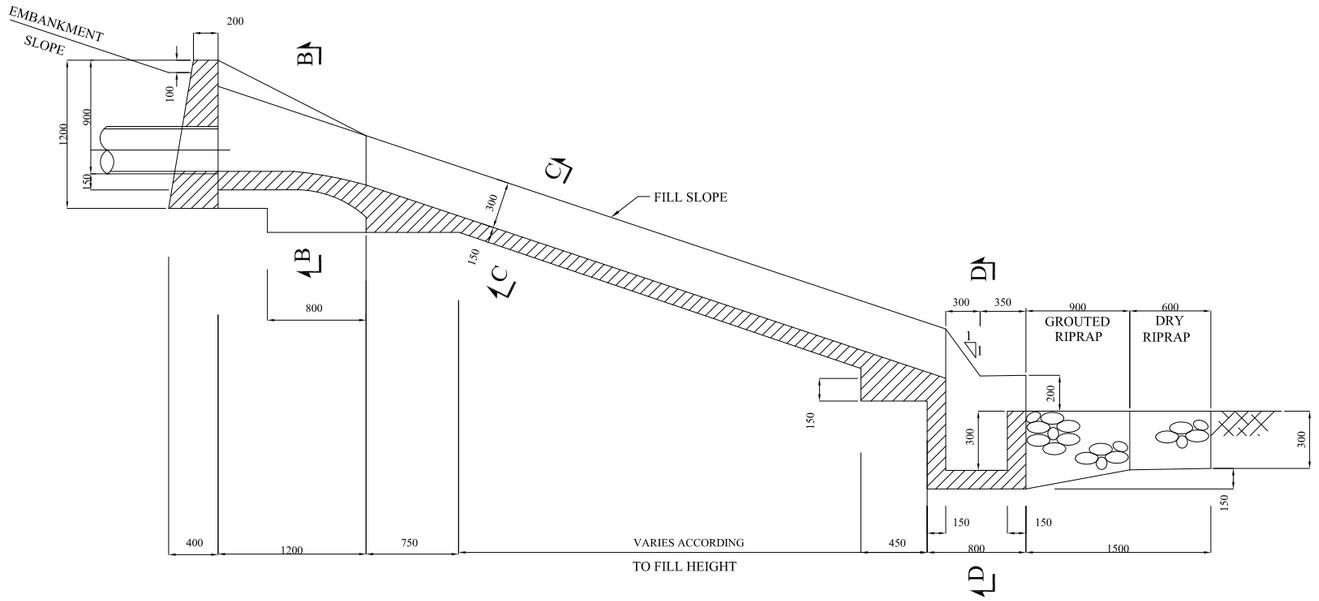
DRAWING TITLE:

DETAILS OF SERVICE DUCTS

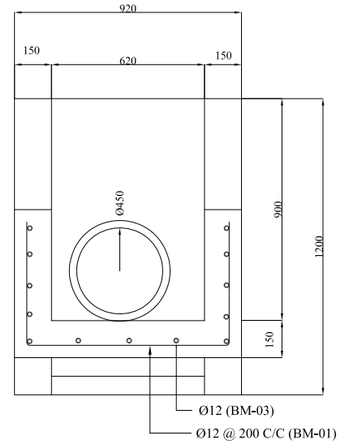
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY:	SCALE:
M. SHAKEEL	N.T.S.
CHECKED BY:	DATE:
ZAFAR ALI	SEP, 2020
APPROVED BY:	REVISION:
M. ANWAR	REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/GEN/18



SECTION A-A



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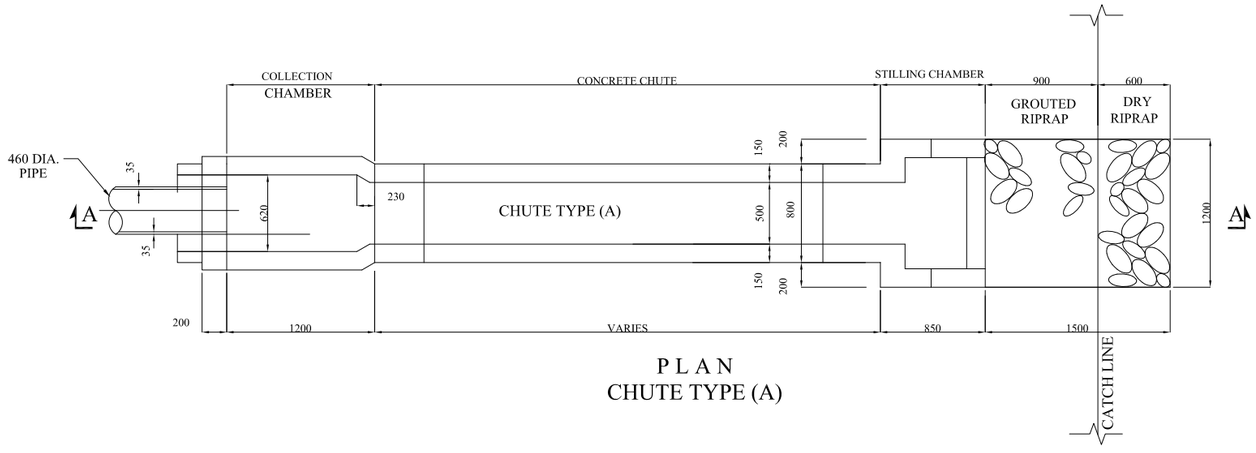
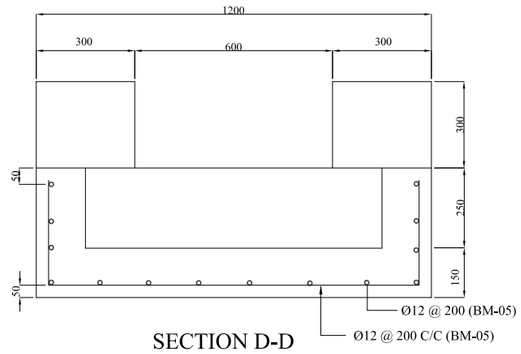
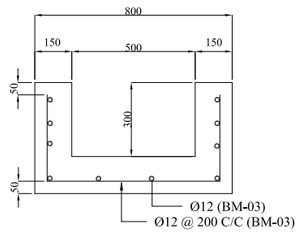


P L A N
CHUTE TYPE (A)



SECTION D-D



SECTION C-C

RE-BAR SCHEDULE

NO.	SHAPE
BM-01	820, VAR.
BM-02	700, 350
BM-03	VARIES
BM-04	1100, 350
BM-05	650, 700, 350

NOTES

1. CONCRETE SHALL BE " CLASS A".
2. RE-BAR SHALL BE GRADE 60 REINFORCEMENT STEEL.
3. ALL DIMENSION ARE IN MM OTHERWISE MENTION.

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

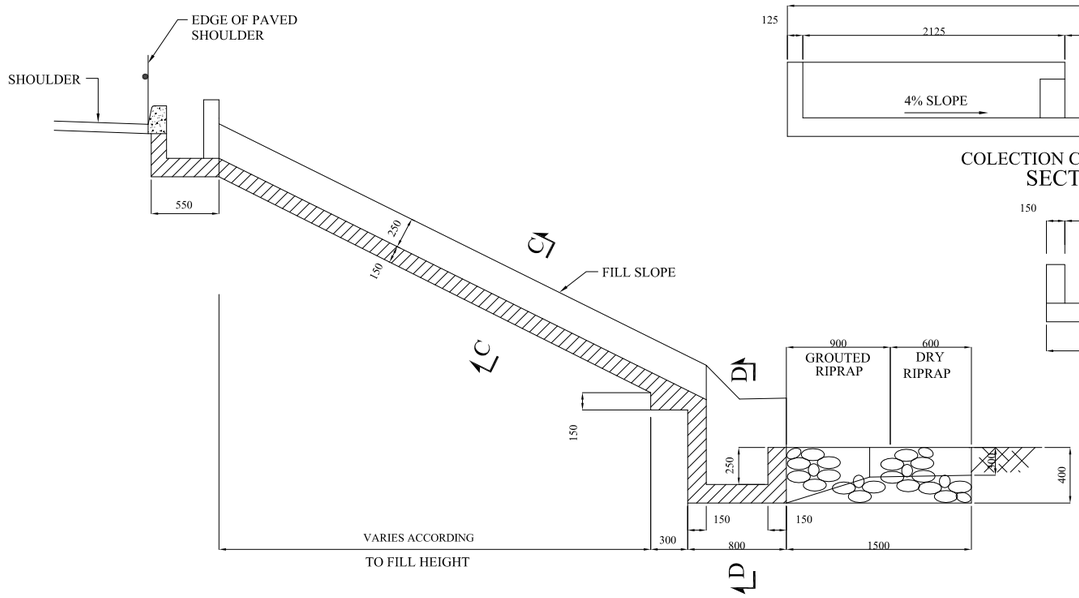
E.P.C. CONCESSIONAIRE:
MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

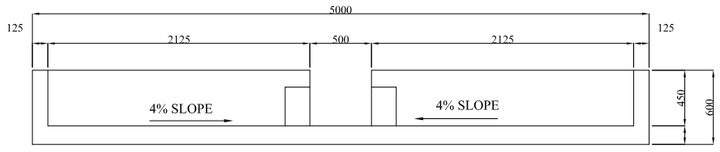
DRAWING TITLE:
CONCRETE CHUTE (TYPE-A)

DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

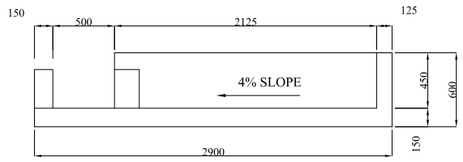
CAD FILE NAME:
LOYA-ZI/MEW/GEN/19



SECTION A-A



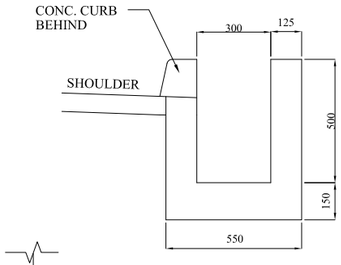
COLECTION CHAMBER TYPE-B
SECTION B-B



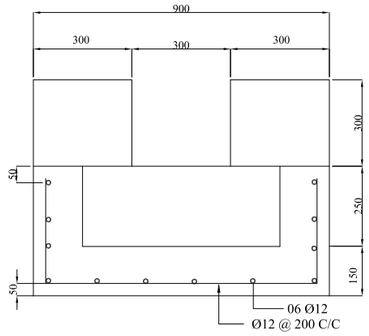
COLECTION CHAMBER TYPE-C
SECTION B-B

RE-BAR SCHEDULE

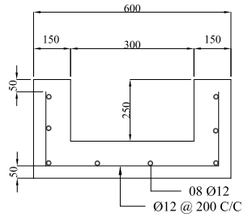
NO.	SHAPE
BM-01	500, VAR.
BM-02	500, 400
BM-03	VARIES



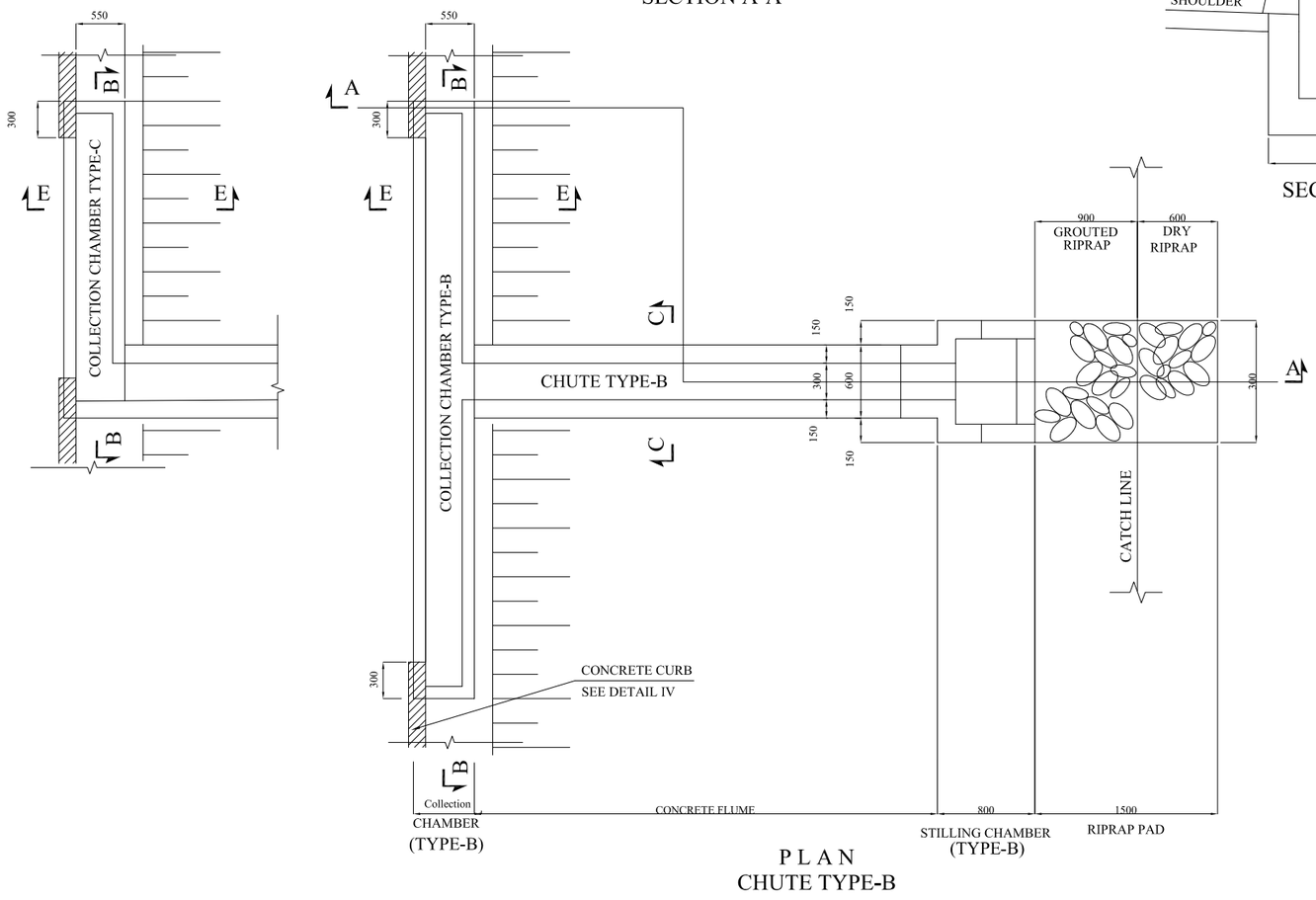
SECTION E-E



SECTION D-D



SECTION C-C



P L A N
CHUTE TYPE-B

NOTES

1 - CONCRETE FOR CHUTES, COLLECTION & STILLING SHALL BE CLASS "A1".
2 - RE-BAR SHALL BE GRADE 40 REINFORCEMENT STEEL.
3 - COLLECTION CHAMBER TYPE-C SHALL BE USED IN LIEU OF TYPE-B, WHEREVER LONGITUDINAL SLOPE OF ROAD EXCEEDS 1.0% AND OR AT OTHER LOCATIONS APPROVED BY ENGINEER.
4 - RIPRAP PLACED ALONG STILLING CHAMBERS SHALL BE CLASS "A".

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

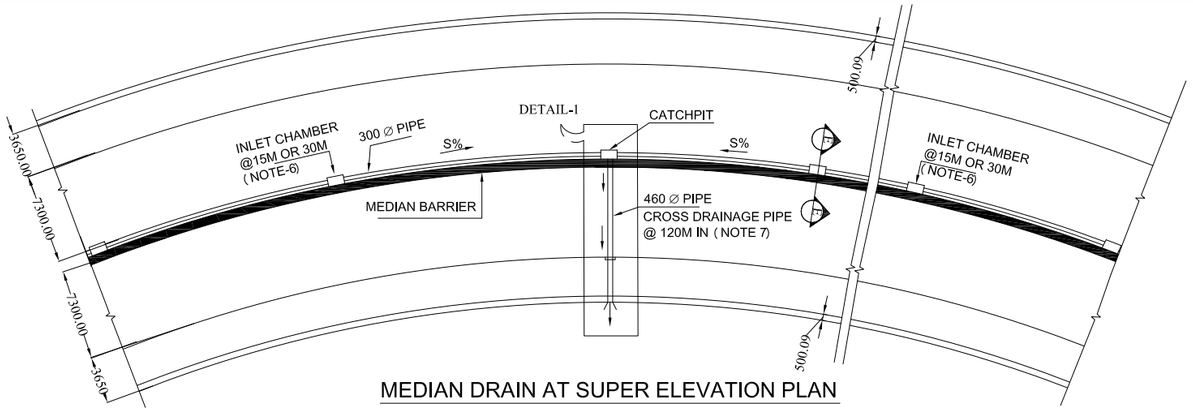
E.P.C. CONCESSIONAIRE:
MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza, I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:
CONCRETE CHUTE (TYPE-B)

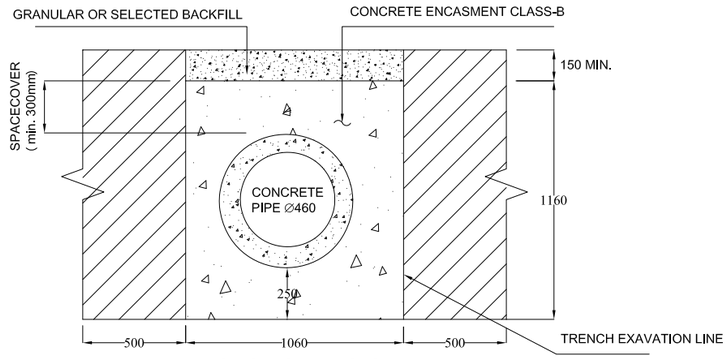
DESIGN BY:	SHEET NO:
AYESHA SHABBIR	
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:
LOYA-ZI/MEW/GEN/20



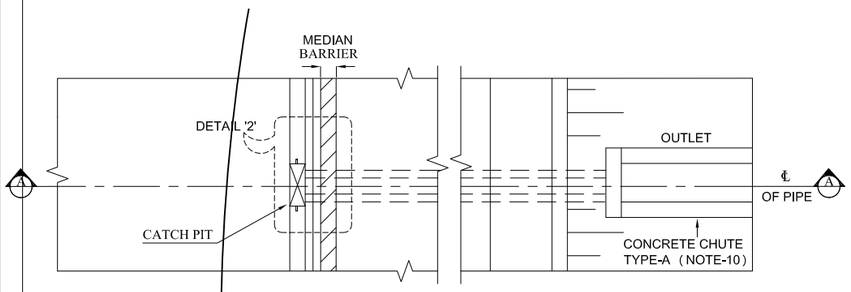
MEDIAN DRAIN AT SUPER ELEVATION PLAN

SCALE 1:500



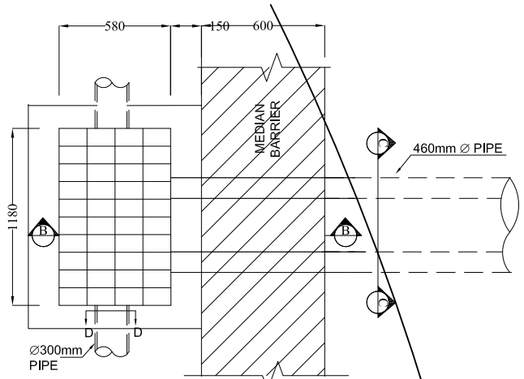
SECTIONAL C-C

SCALE 1:30



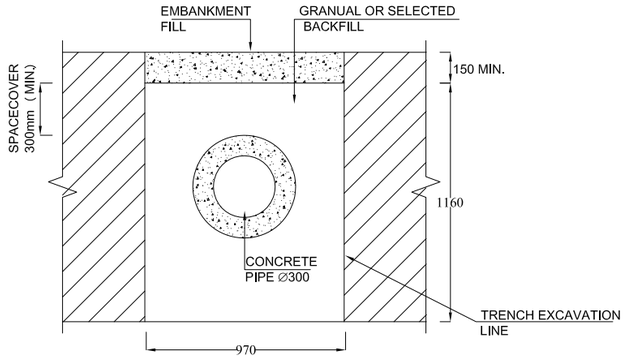
CATCH PIT PLAN DETAIL-1

SCALE 1:40



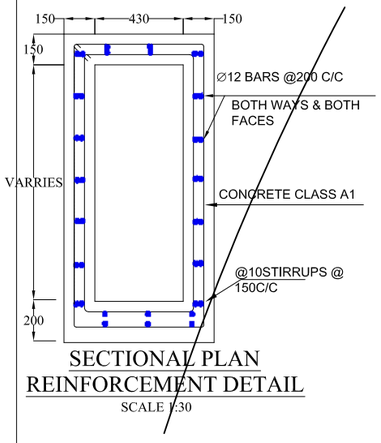
DETAIL - 2

SCALE 1:30



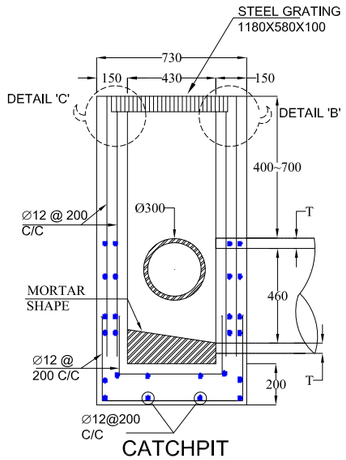
SECTION D-D

SCALE 1:30



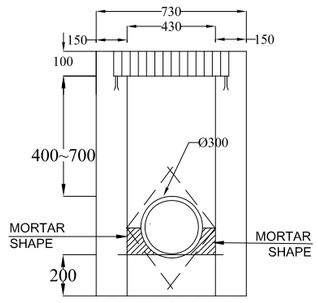
SECTIONAL PLAN REINFORCEMENT DETAIL

SCALE 1:30



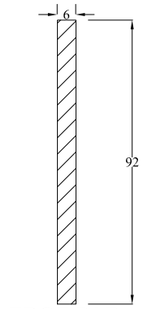
CATCHPIT SECTION B-B

SCALE 1:30



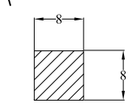
SECTION C-C

SCALE 1:30



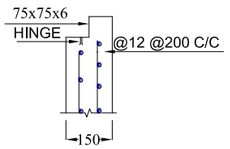
EDGE BAR

SCALE 1:2



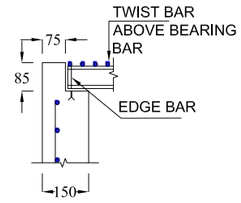
TWIST BAR

SCALE 1:1



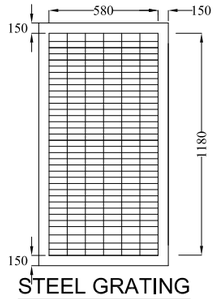
DETAIL-'B'

SCALE 1:20



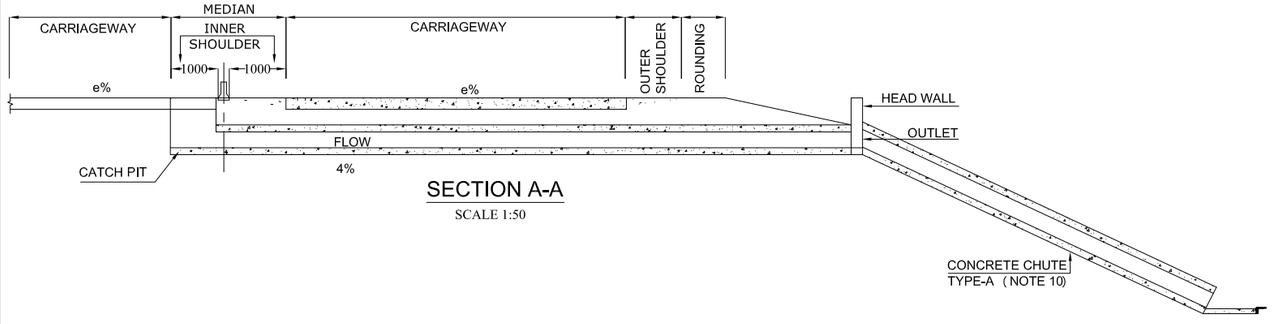
DETAIL - 'C'

SCALE 1:20



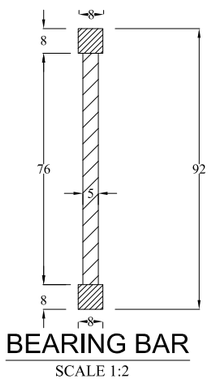
STEEL GRATING

SCALE 1:30



SECTION A-A

SCALE 1:50



BEARING BAR

SCALE 1:2

NOTES

1- ALL DIMENSION ARE IN MILLIMETERS UNLESS SHOWN OTHERWISE.
2- MEDIAN CATCH PIT AND CROSS DRAINAGE PIPE SHALL BE PROVIDED AT LOCATION SHOWN ON PLANS AND/OR AS DIRECTED BY THE ENGINEER.
3- MINIMUM SLOPE OF CROSS DRAINAGE SHALL BE 0.5%.
4- CROSS DRAINAGE PIPE SHALL BE ENCASED USING CONCRETE CLASS -B THICKNESS OF ENCASEMENT SHALL BE MINIMUM 250 ALL AROUND.
5- THE DEPTH OF CATCH PIT MAY BE INCREASED TO SUIT SIDE CONDITION SUBJECT TO APPROVAL OF THE ENGR.
6- INLET CHAMBER INTERVAL SHALL BE FIXED AS;
FOR ROAD GRADIENT 0.125% @15MM C/C
FOR ROAD GRADIENT 0.250% TO 1.500% @30 M C/C .
7- CROSS DRAINAGE PIPE SHALL BE PROVIDED AT 120M INTERVAL STARTING FROM THE LOWEST POINT OR ADJACENT TO BRIDGE APPROACH SLAB (IF BRIDGE IS AT SAG POINT)
8- NO INLET CHAMBER SHALL BE PROVIDED IN THE REACH 150M EACH SIDE OF THE CREST POINT.
9- MATERIAL AND SHAPE THE STEEL GRATING MAY BE CHANGED WITH APPROVAL OF THE ENGINEER SUBJECT TO BEING CAPABLE OF TACKING HEAVY TRAFFIC LOAD.

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES
(DESIGN AND FINANCIAL
CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

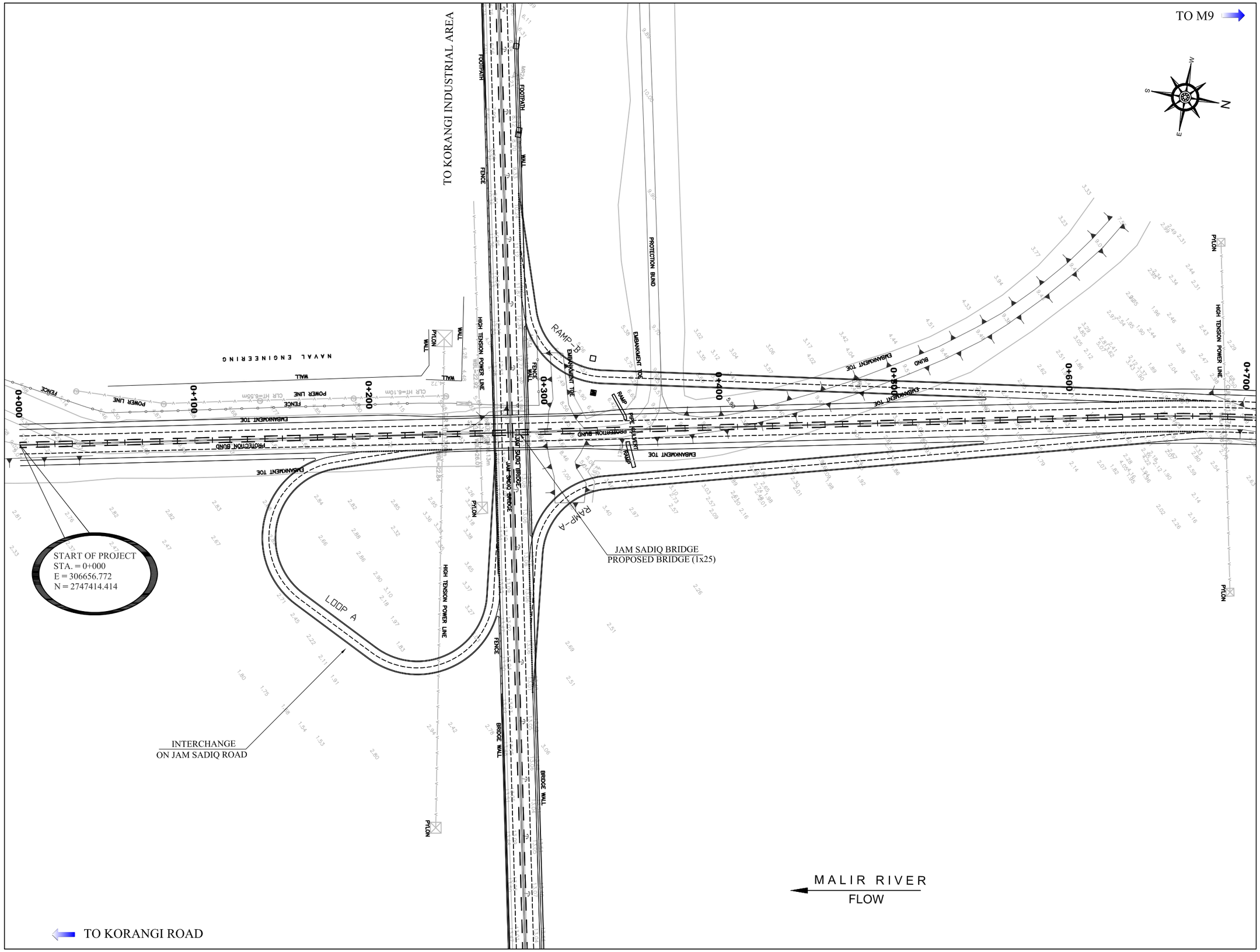
DRAWING TITLE:

TYPICAL MEDIAN DRAINAGE DETAIL IN SUPER-ELEVATED SECTION

DESIGN BY: AYESHA SHABBIR	SHEET NO:
DRAWN BY: M. SHAKEEL	SCALE: N.T.S.
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/GEN/27



NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

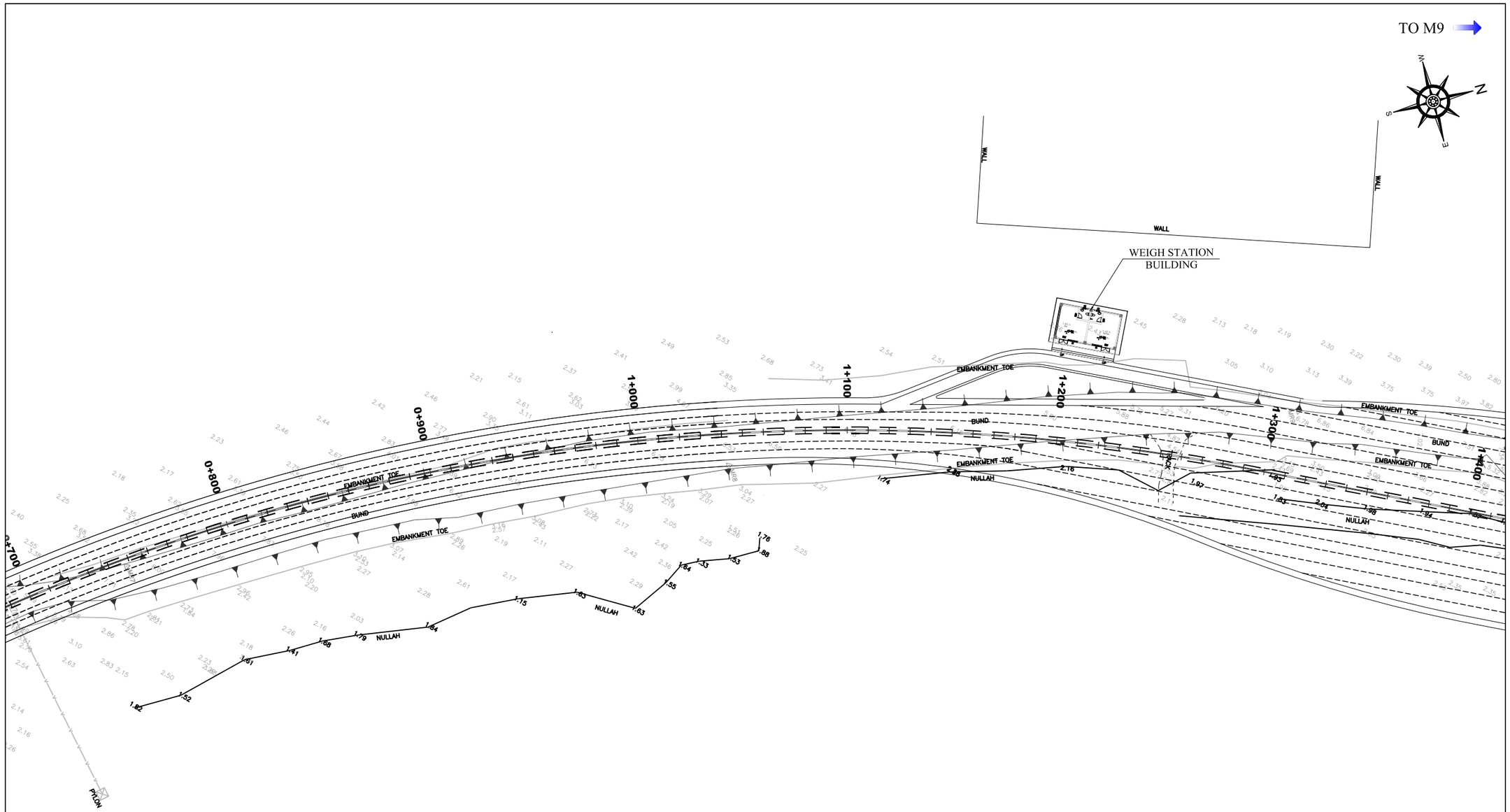
DRAWING TITLE:

PLAN AT KM
0+000 TO 0+700

DESIGN BY: AYSHA SHABBIR	SHEET NO: 01 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/01



NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

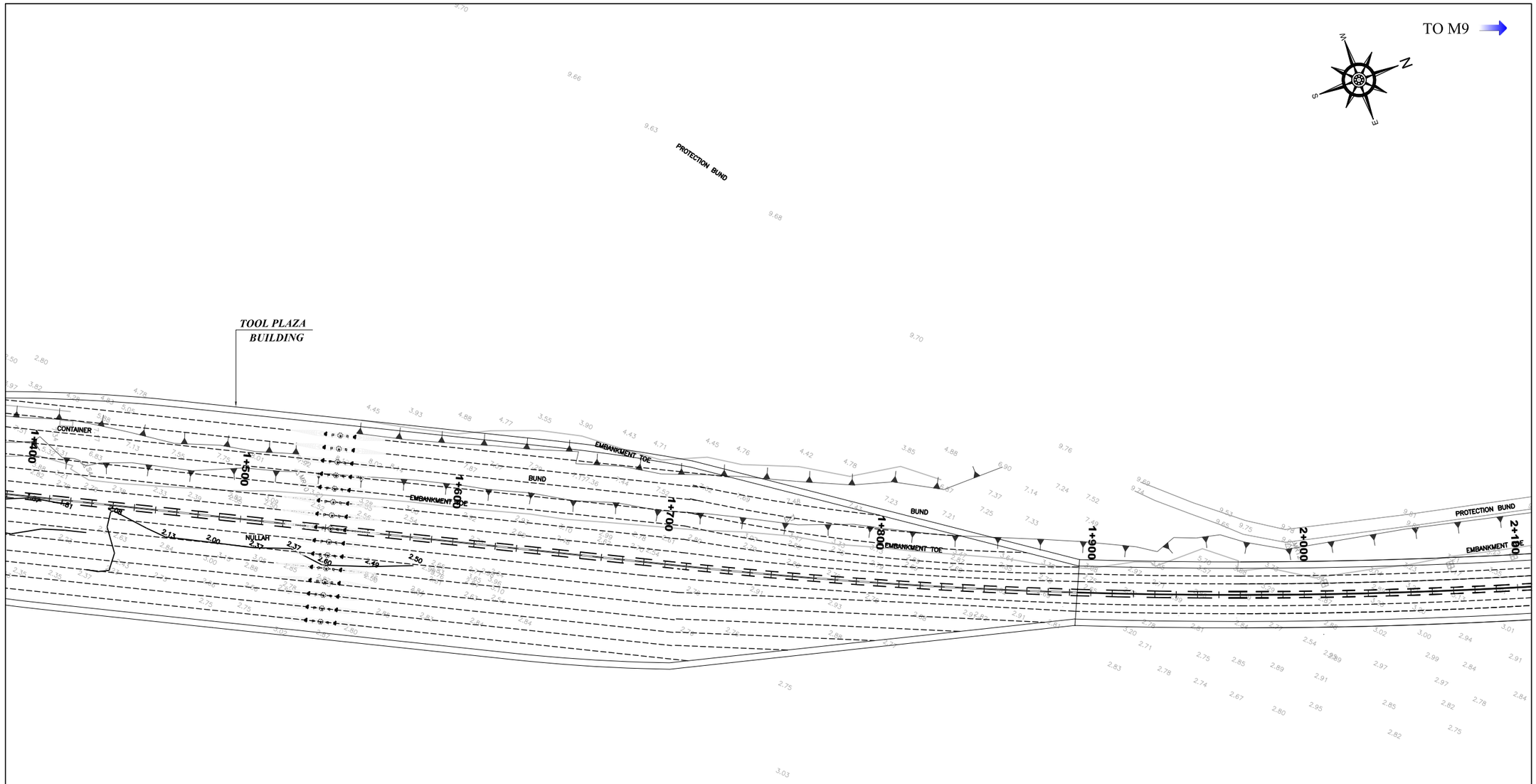
PLAN AT KM
0+700 TO 1+400

DESIGN BY: AYSHA SHABBIR	SHEET NO: 02 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/02

TO M9



MALIR RIVER
FLOW

TO KORANGI ROAD

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER
DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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(DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

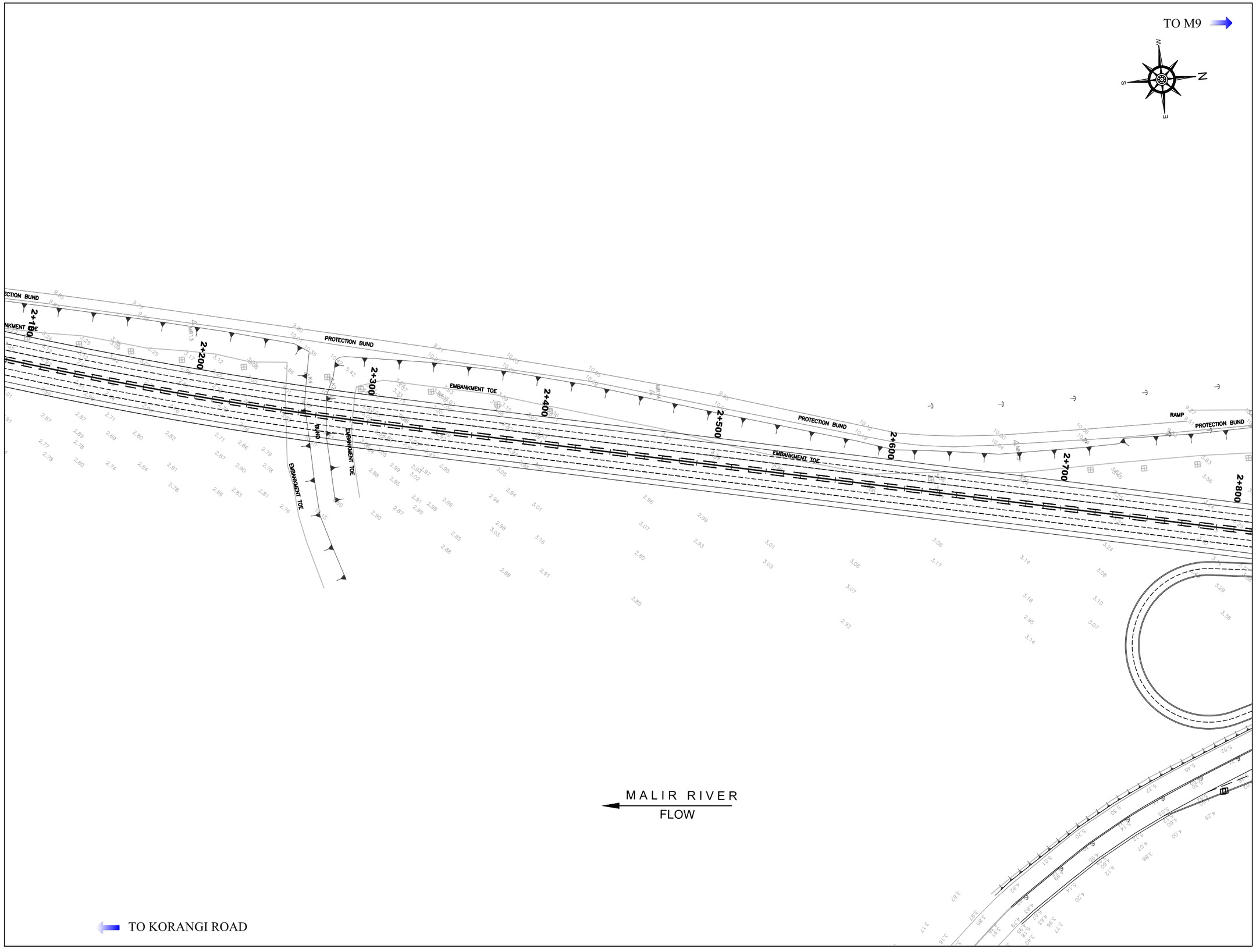
DRAWING TITLE:

PLAN AT KM
1+400 TO 2+100

DESIGN BY: AYSHA SHABBIR	SHEET NO: 03 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/03



NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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ZEERUK INTERNATIONAL (PVT)LTD
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I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

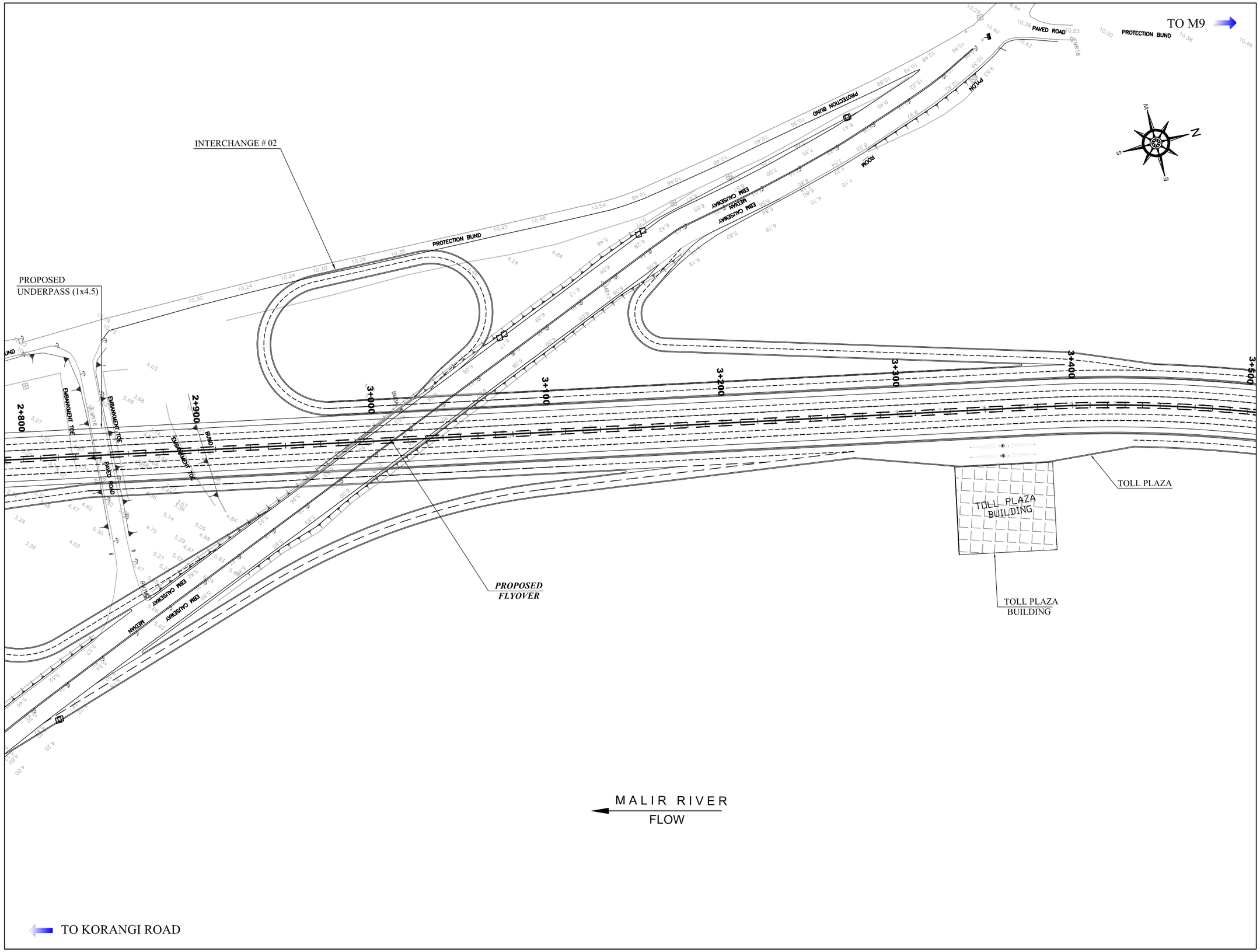
DRAWING TITLE:

PLAN AT KM
2+100 TO 2+800

DESIGN BY: AYSHA SHABBIR	SHEET NO: 04 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/04



NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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3rd Floor, Time Square Plaza,
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Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

PLAN AT KM
2+800 TO 3+500

DESIGN BY: AYSHA SHABBIR	SHEET NO: 05 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/05

TO M9

N
W
E
S

10.65
10.62
PROTECTION BUND
10.63
10.66
10.64
10.57
10.19
8.01
7.66
7.23
6.97
6.76
6.61
6.27
6.12
PROTECTION BUND
6.10
6.12
6.18
6.36

TOLL PLAZA BUILDING

3+500
3+600
3+700
3+800
3+900
4+000
4+100
4+200

PROPOSED
UNDERPASS (1x4.5)

MALIR RIVER
FLOW

TO KORANGI ROAD

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER
DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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3rd Floor, Time Square Plaza,
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Ph: 051-4938213-4, FAX: 051-4938215

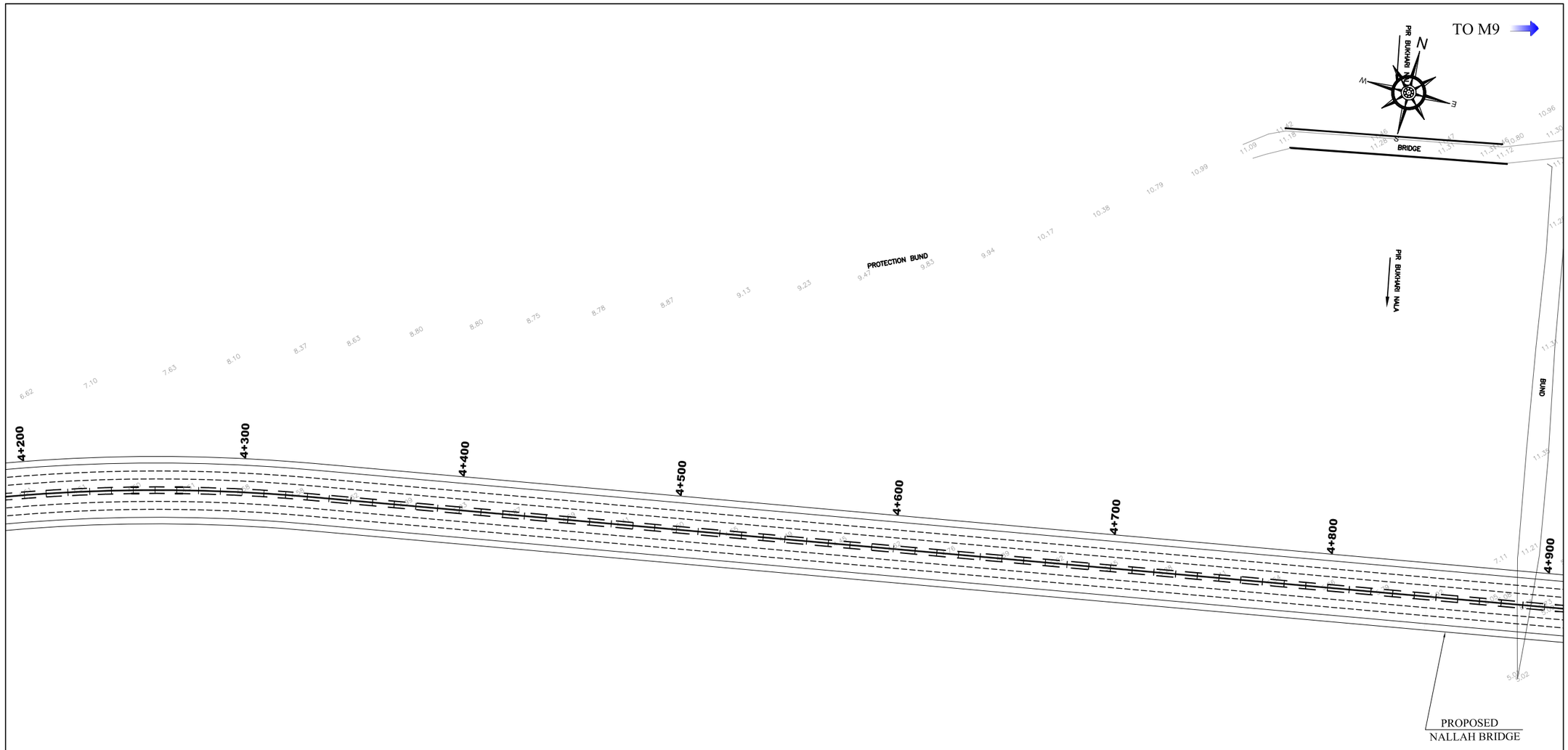
DRAWING TITLE:

PLAN AT KM
3+500 TO 4+200

DESIGN BY: AYSHA SHABBIR	SHEET NO: 06 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/06



NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER
DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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(DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

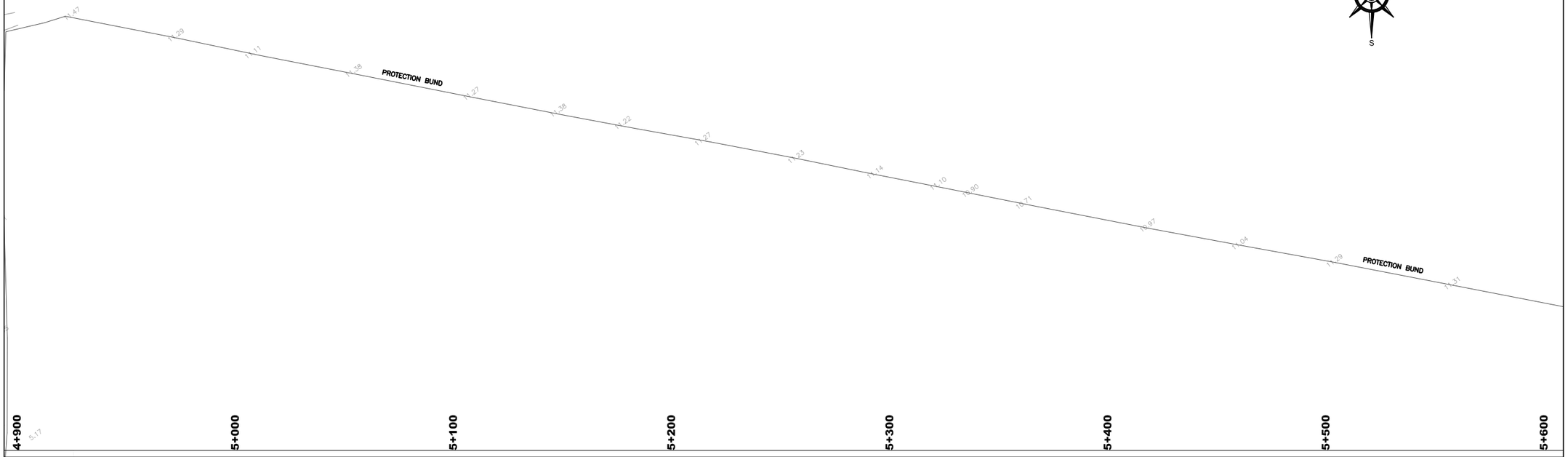
PLAN AT KM
4+200 TO 4+900

DESIGN BY: AYSHA SHABBIR	SHEET NO: 07 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/07

TO M9



MALIR RIVER
FLOW

TO KORANGI ROAD

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE
MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
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ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza, I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:
PLAN AT KM
4+900 TO 5+600

DESIGN BY: AYSHA SHABBIR	SHEET NO: 08 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:
LOYA-ZI/MEW/PL/08

TO M9

N
W E
S

CHAKORA NALA

11.51 11.49 11.50 11.47 11.52 11.54 11.6 11.58 11.56 11.54 11.52 11.64 11.62 11.66

TBM.3A

BRIDGE

TBM.3B

WATER TANK

RANGER CHECK POST

5+600 5+700 5+800 5+900 6+000 6+100 6+200 6+300

PROTECTION BUND

11.90 11.51 11.81 11.92 12.00

CHAKORA NALA

PROPOSED
BRIDGE (4x2.5)

MALIR RIVER
FLOW

TO KORANGI ROAD

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER
DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

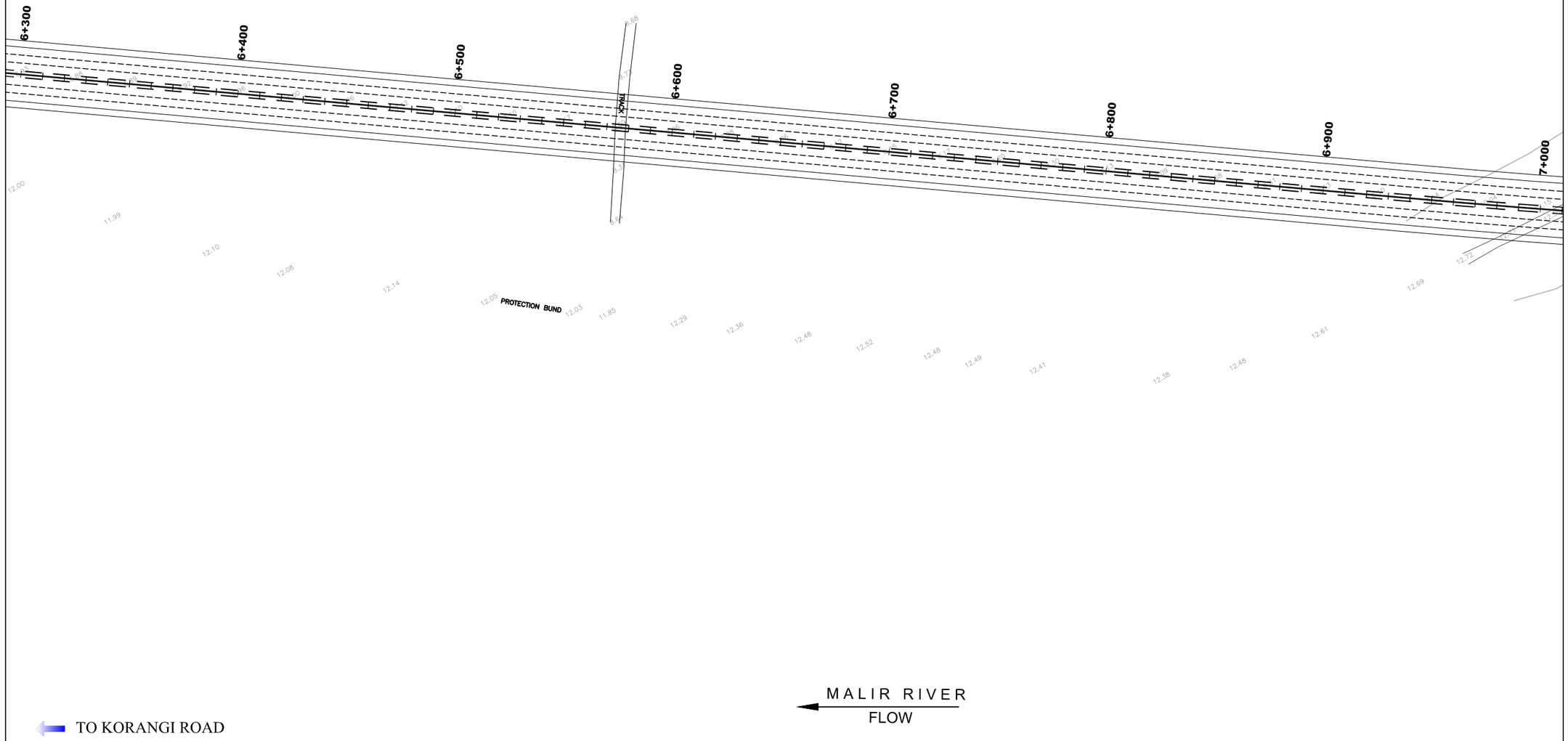
PLAN AT KM
5+600 TO 6+300

DESIGN BY: AYSHA SHABBIR	SHEET NO: 09 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/09

TO M9



TO KORANGI ROAD

MALIR RIVER
FLOW

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
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3rd Floor, Time Square Plaza,
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Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

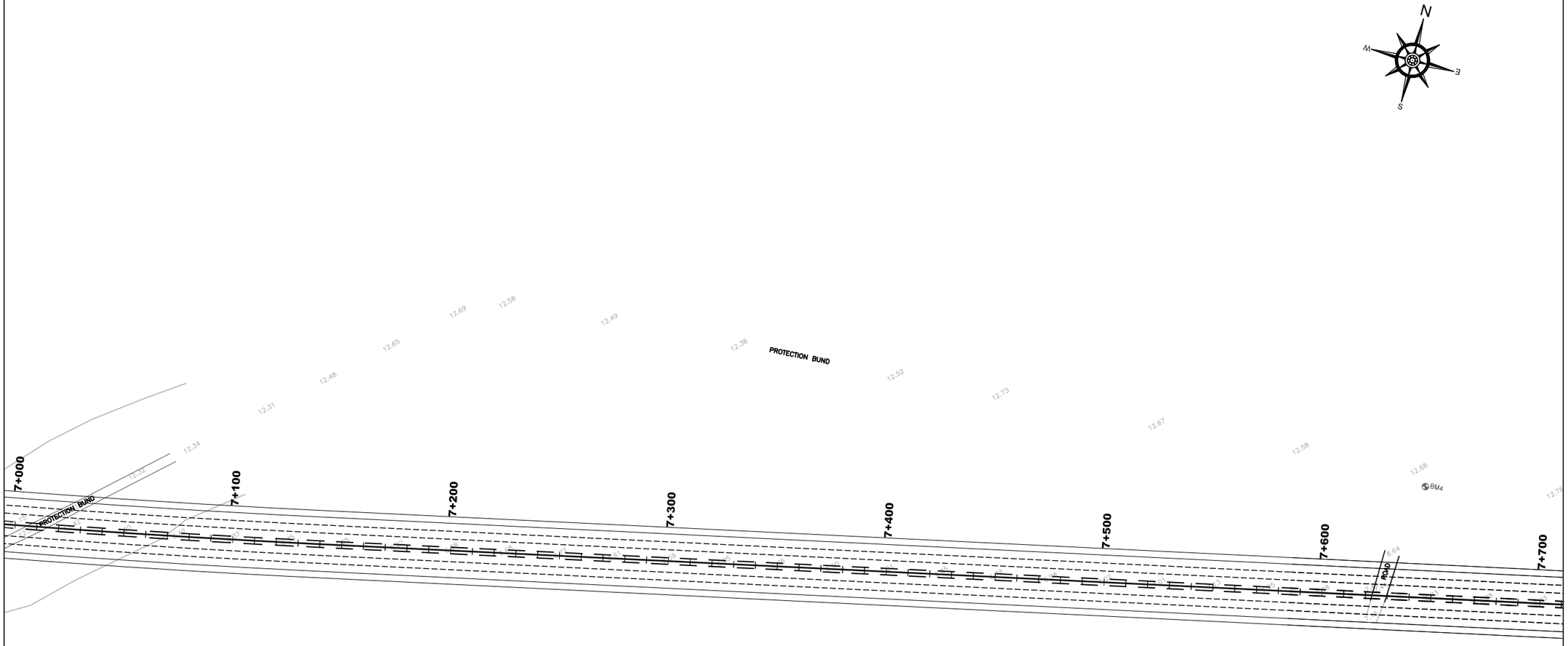
PLAN AT KM
6+300 TO 7+000

DESIGN BY: AYSHA SHABBIR	SHEET NO: 10 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/10

TO M9



MALIR RIVER
FLOW

TO KORANGI ROAD

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

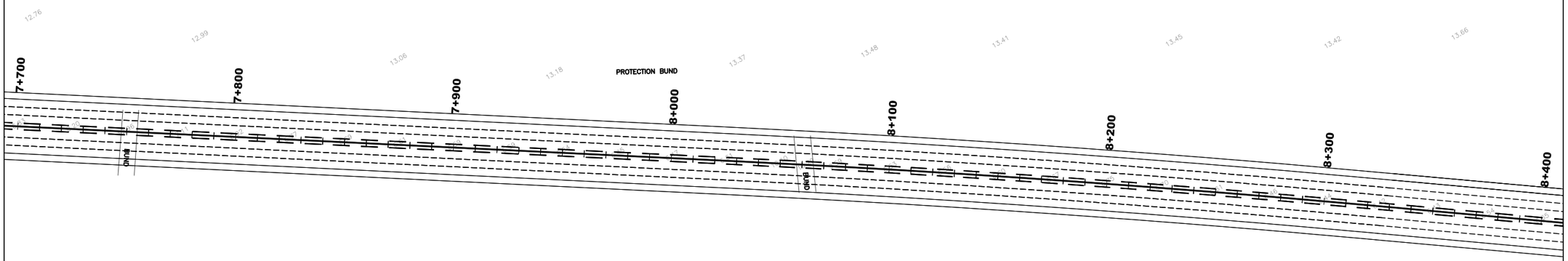
PLAN AT KM
7+000 TO 7+700

DESIGN BY: AYSHA SHABBIR	SHEET NO: 11 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/11

TO M9



BM4A

MALIR RIVER
FLOW

TO KORANGI ROAD

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

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Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

PLAN AT KM
7+700 TO 8+400

DESIGN BY: AYSHA SHABBIR	SHEET NO: 12 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/12

TO M9

N
W
E
S

13.90
13.93
13.99
PROTECTION BUND
13.86
13.90
13.86
13.66
13.42

TOLL PLAZA BUILDING

8+300 8+400 8+500 8+600 8+700 8+800 8+900 9+000

BRIDGE

TOLL PLAZA

MALIR RIVER
FLOW

TO KORANGI ROAD

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

PLAN AT KM
8+300 TO 9+100

DESIGN BY: AYSHA SHABBIR	SHEET NO: 13 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/13

TO M9

N
W
E
S

RAMP A
LOOP A
SHAH FAISAL – KORANGI BRIDGE
SHAH FAISAL BRIDGE WALL
RAMP B
TOLL PLAZA
9+100
9+200
9+300
9+400
9+500
9+600
9+700
9+800
RAMP C
TOLL PLAZA BUILDING
LOOP B
LOOP C
INTERCHANGE ON KORANGI-SHAH FAISAL ROAD
INTERCHANGE BRIDGE
MALIR RIVER
FLOW
TO KORANGI ROAD

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

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3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

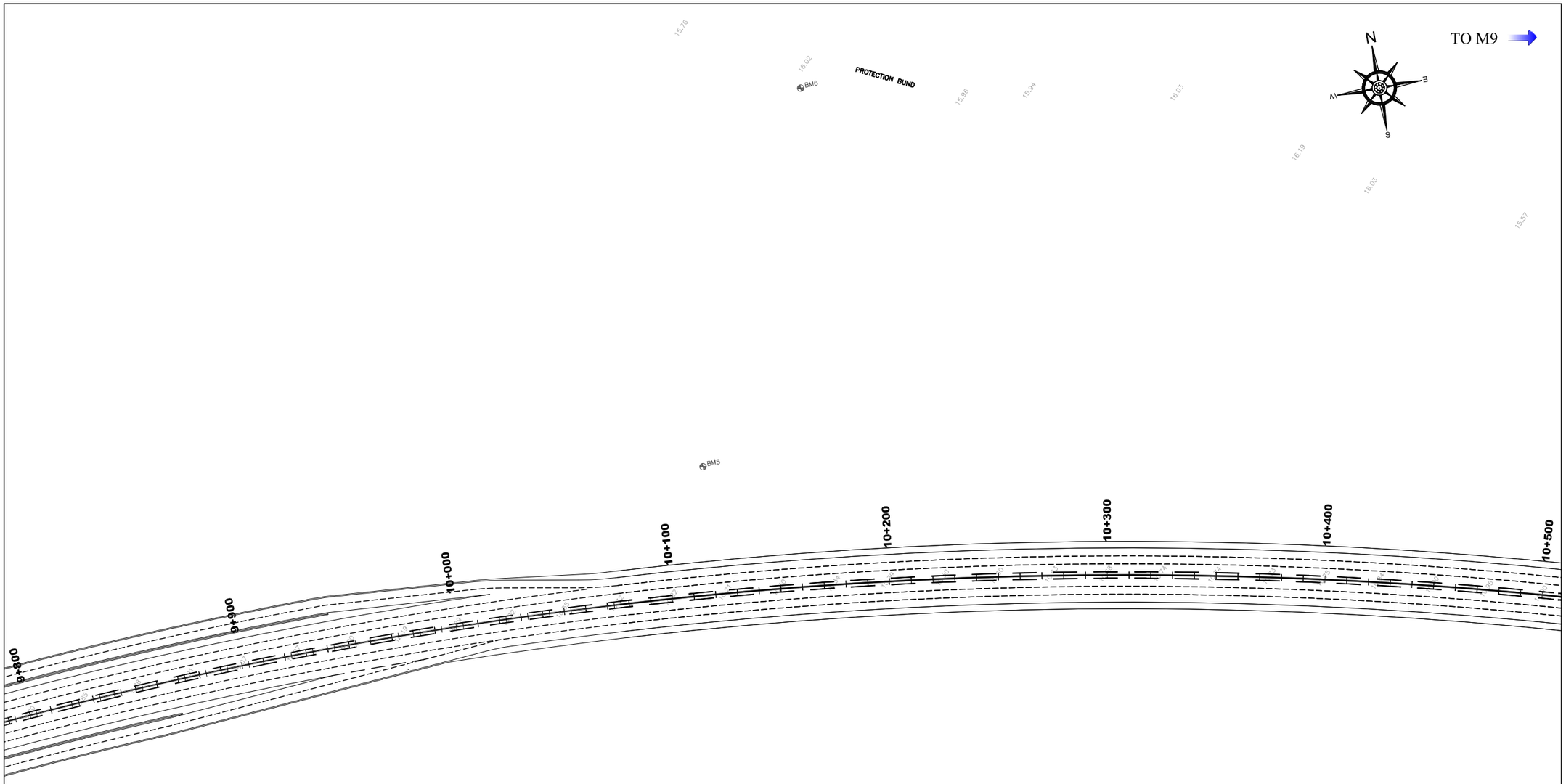
DRAWING TITLE:

PLAN AT KM
9+100 TO 9+800

DESIGN BY: AYSHA SHABBIR	SHEET NO: 14 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/14



NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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3rd Floor, Time Square Plaza,
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Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

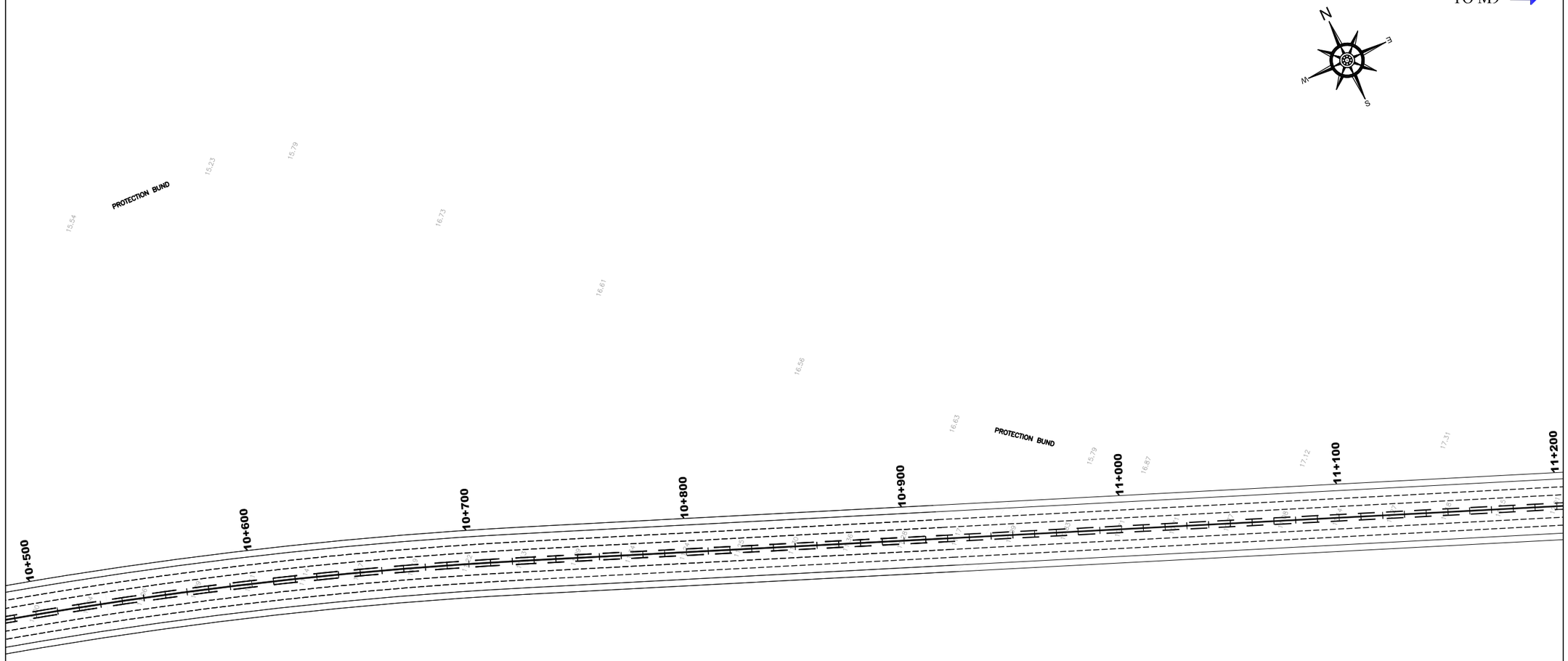
PLAN AT KM
9+800 TO 10+500

DESIGN BY: AYSHA SHABBIR	SHEET NO: 15 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/15

TO M9



MALIR RIVER
FLOW

TO KORANGI ROAD

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

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3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

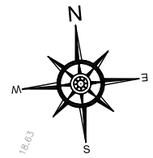
PLAN AT KM
10+500 TO 11+200

DESIGN BY: AYSHA SHABBIR	SHEET NO: 16 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/16

TO M9



18.63
18.97
18.44
18.33
18.57
18.26
18.25
17.88
17.98
PROTECTION BUND
18.00
17.83

11+200 11+300 11+400 11+500 11+600 11+700 11+800 11+900

BUND

MALIR RIVER
FLOW

TO KORANGI ROAD

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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(DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

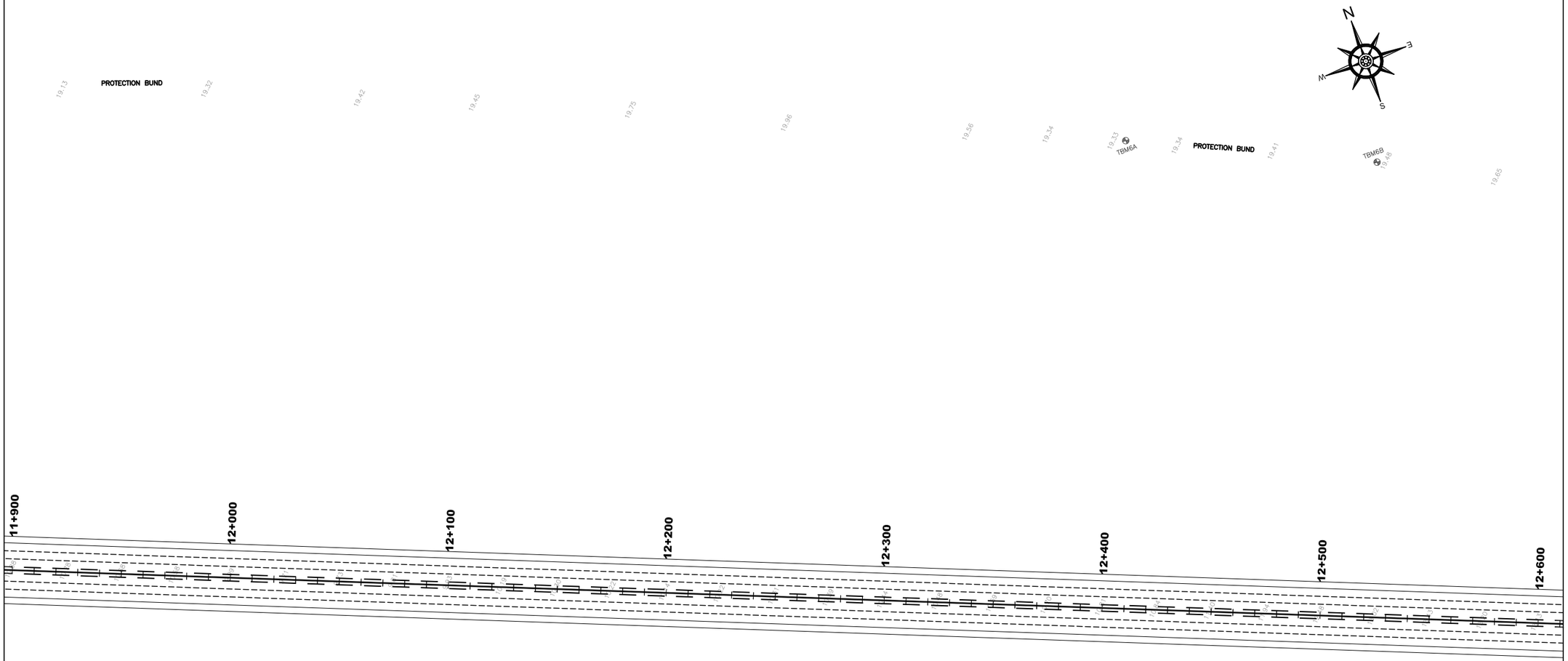
PLAN AT KM
11+200 TO 11+900

DESIGN BY: AYSHA SHABBIR	SHEET NO: 17 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/17

TO M9



MALIR RIVER
FLOW

TO KORANGI ROAD

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

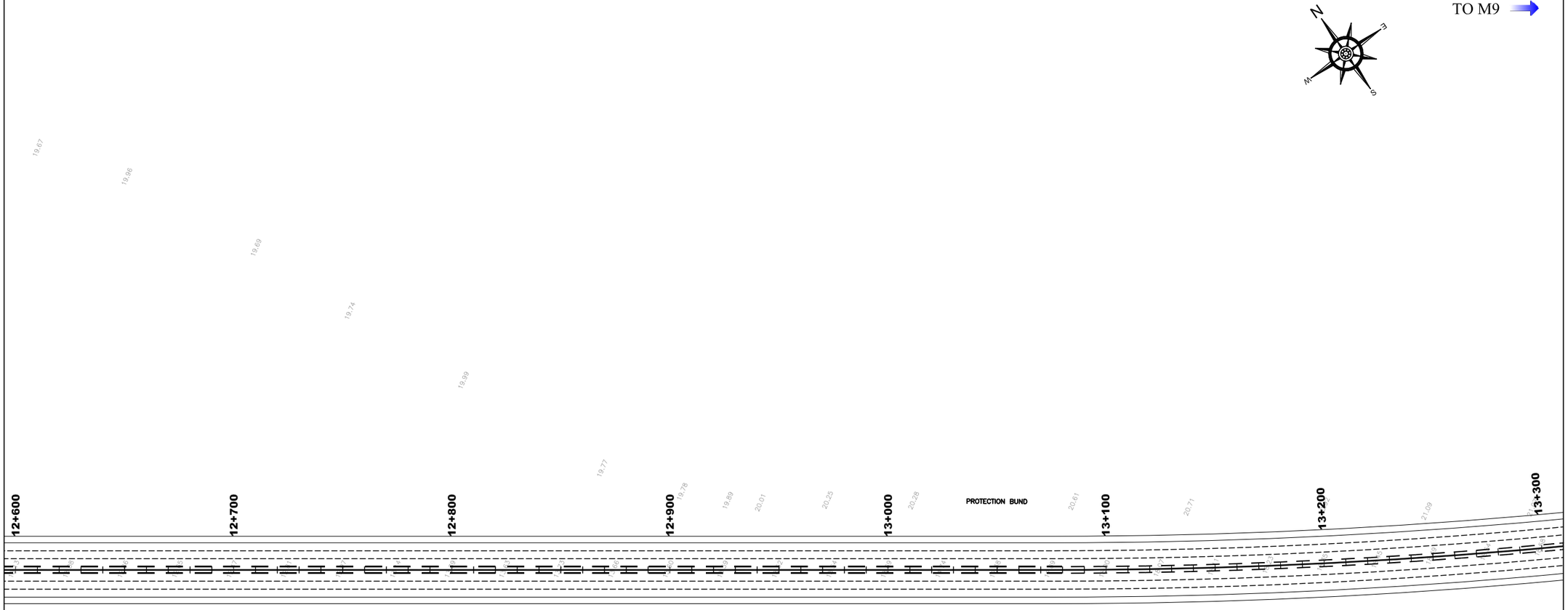
PLAN AT KM
11+900 TO 12+600

DESIGN BY: AYSHA SHABBIR	SHEET NO: 18 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/18

TO M9



TO KORANGI ROAD

MALIR RIVER
FLOW

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

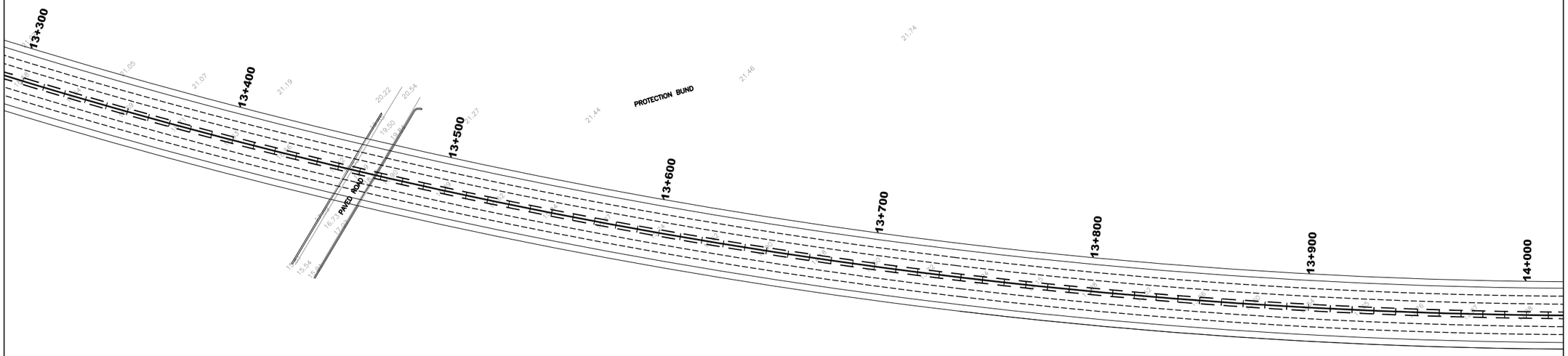
PLAN AT KM
12+600 TO 13+300

DESIGN BY: AYSHA SHABBIR	SHEET NO: 19 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/19

TO M9



TO KORANGI ROAD

MALIR RIVER
FLOW

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES
(DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

PLAN AT KM
13+300 TO 14+000

DESIGN BY: AYSHA SHABBIR	SHEET NO: 20 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/20

TO M9

N

W E

S

22.15 22.17 22.25 22.15 PROTECTION BUND 22.13 22.47 22.76 22.95 23.00 23.08 23.20 23.33 23.73 23.91 24.05 PROTECTION BUND

14+000 14+100 14+200 14+300 14+400 14+500 14+600 14+700

MALIR RIVER
FLOW

TO KORANGI ROAD

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER
DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

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(DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

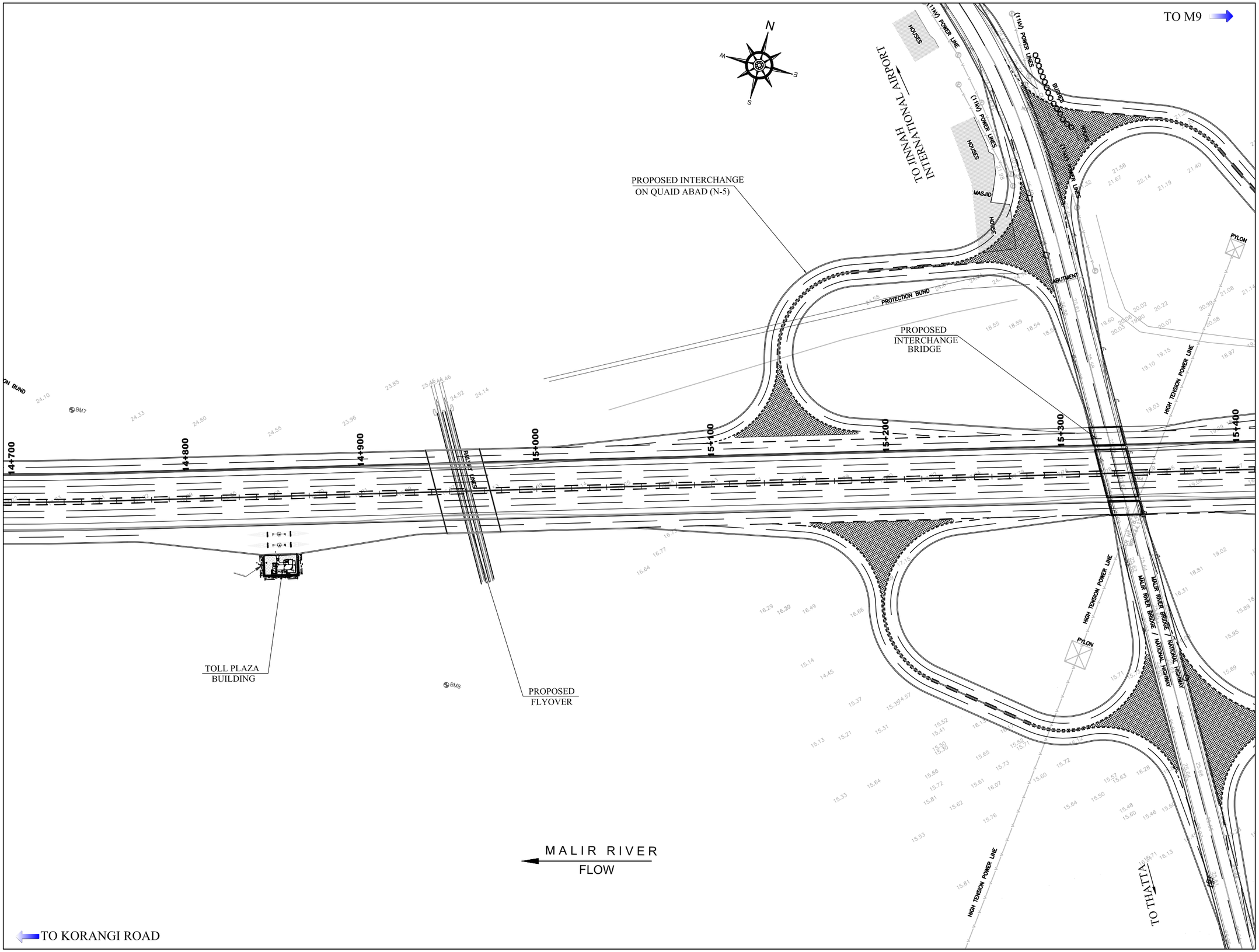
DRAWING TITLE:

PLAN AT KM
14+000 TO 14+700

DESIGN BY:	SHEET NO:
AYSHA SHABBIR	21 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/21



NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

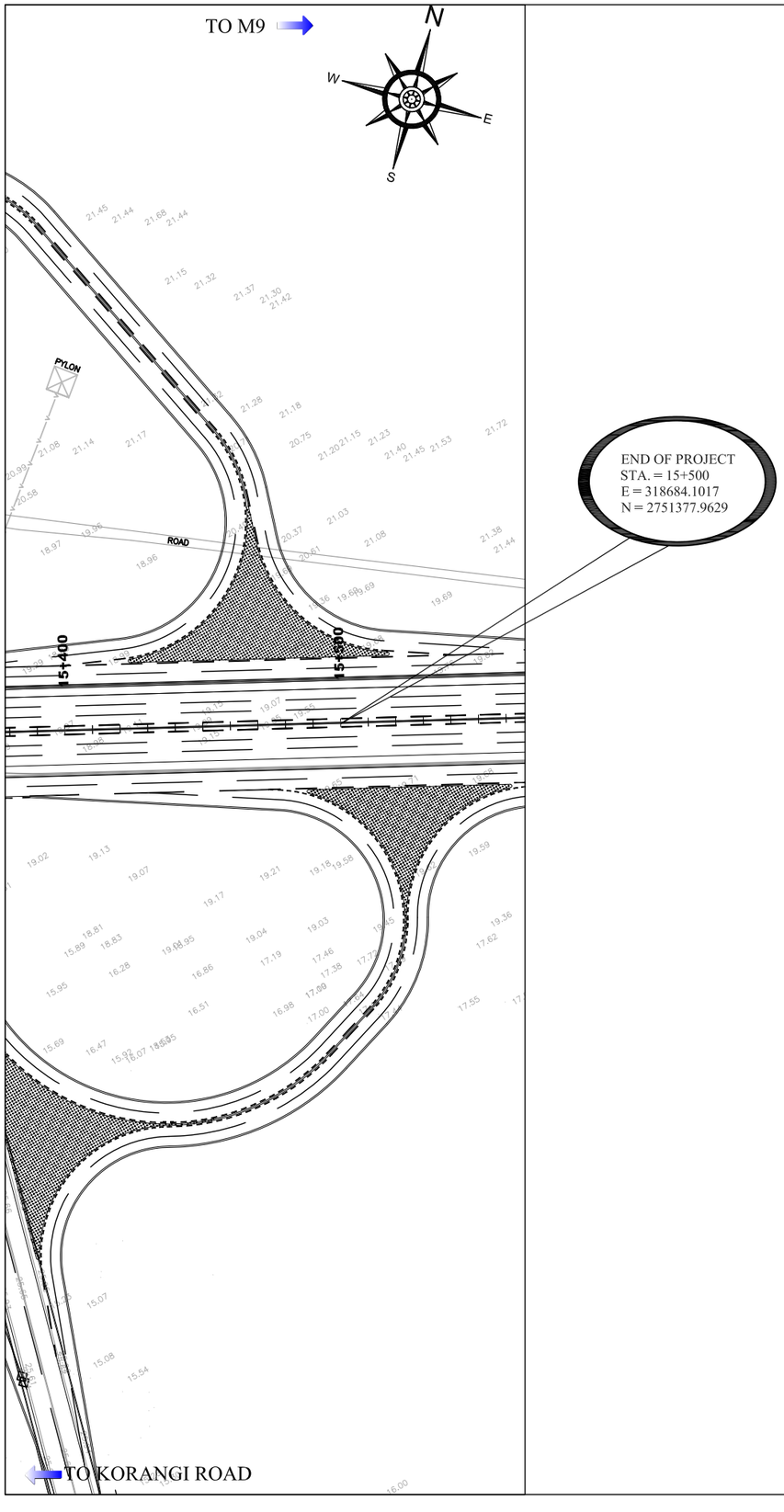
DRAWING TITLE:

PLAN AT KM 14+700 TO 15+400

DESIGN BY: AYSHA SHABBIR	SHEET NO: 22 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/22



NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: LOYA-ZI/MEW/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: LOYA-ZI/MEW/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: LOYA-ZI/MEW/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:LOYA-ZI/MEW/GEN/07
6. FOR EMBANPLAN AT KMENT PROTECTION REFER DWG NO: LOYA-ZI/MEW/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

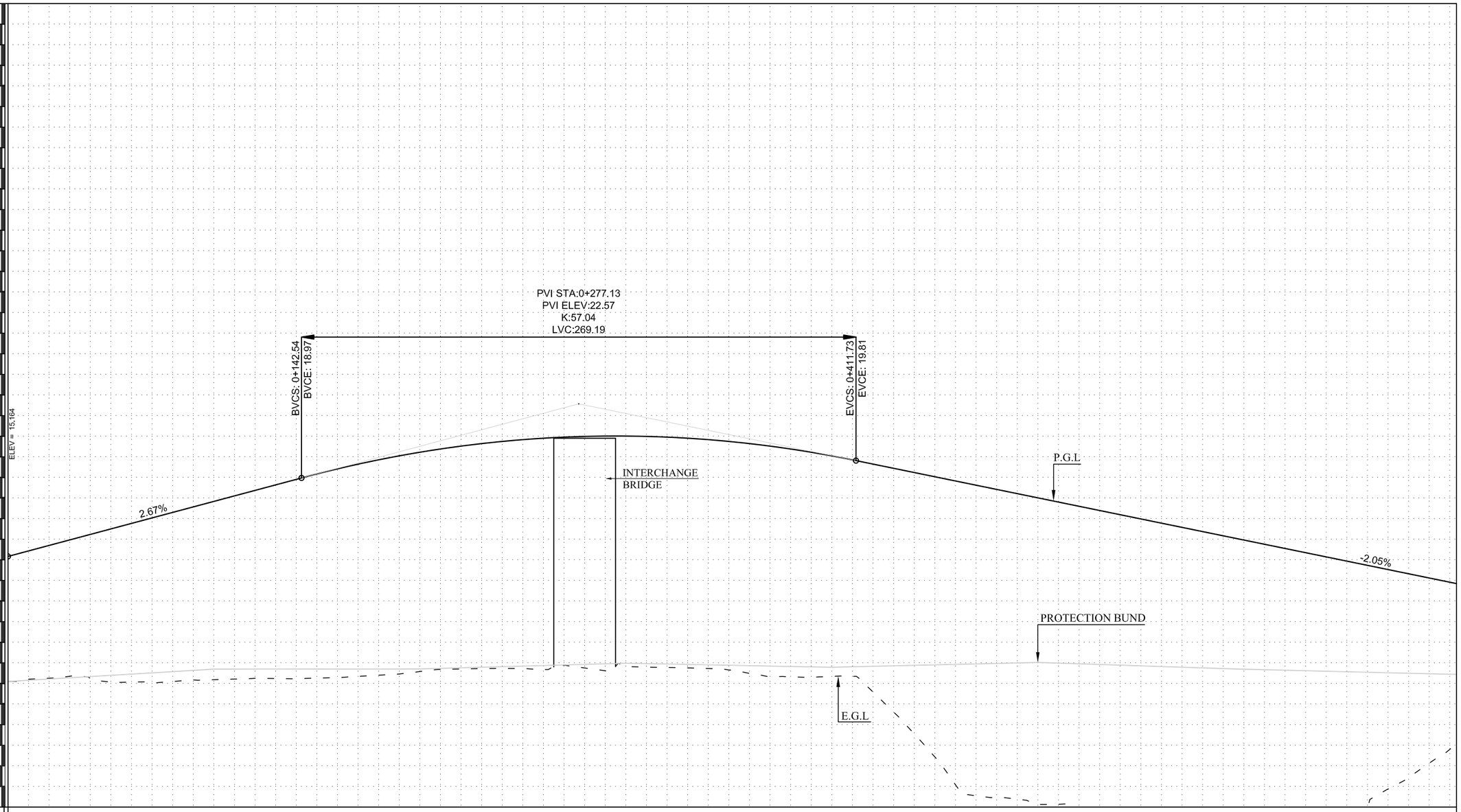
DRAWING TITLE:

PLAN AT KM
15+400 TO 15+500

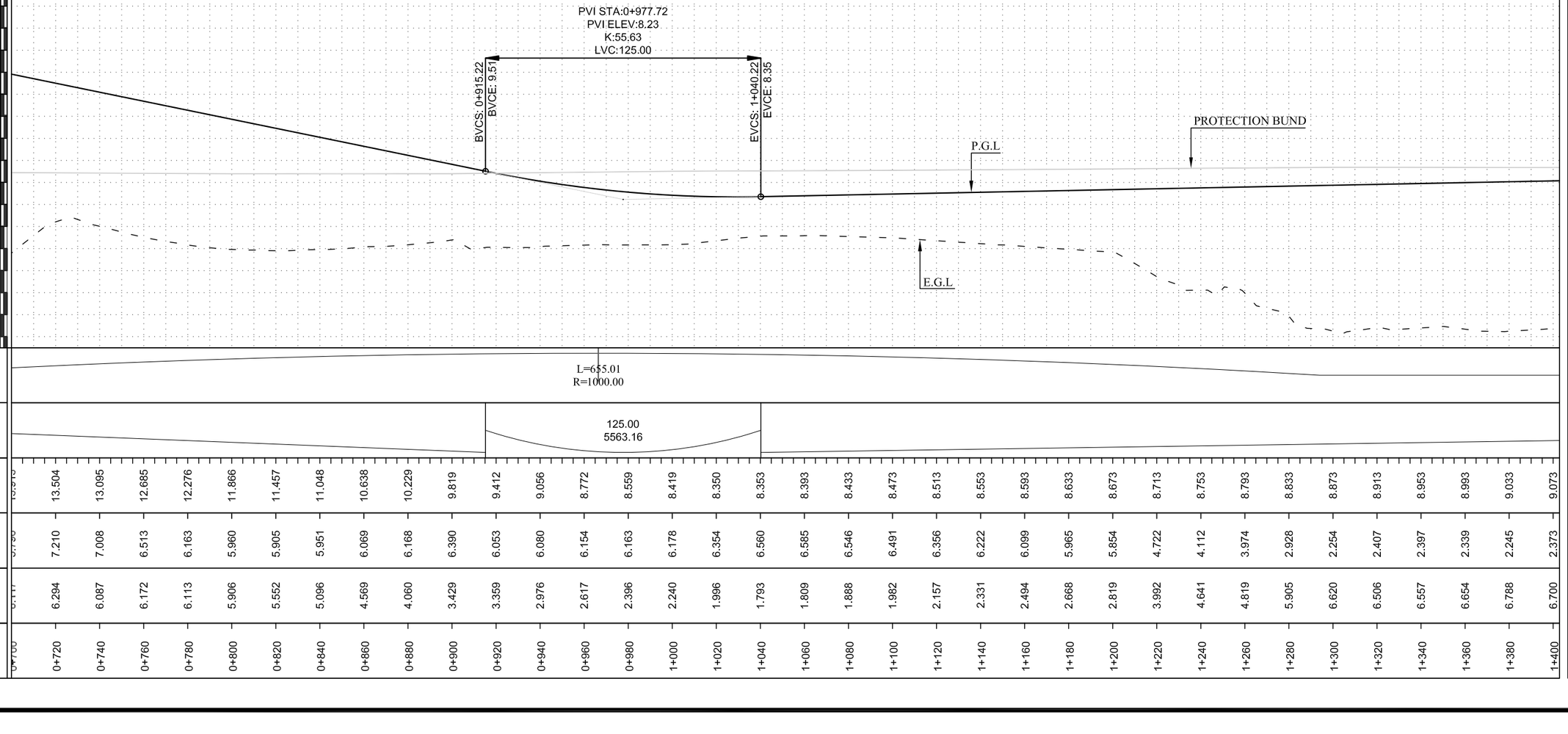
DESIGN BY: AYSHA SHABBIR	SHEET NO: 23 of 23
DRAWN BY: M. SHAKEEL	SCALE: H= 1:2000
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

LOYA-ZI/MEW/PL/22


PVI STA:0+277.13
PVI ELEV:22.57
K:57.04
LVC:269.19
BVCS: 0+142.54
BVCE: 18.97
EVCS: 0+411.73
EVCE: 19.81
ELEV = 15.164
2.67%
-2.05%
INTERCHANGE
BRIDGE
P.G.L
PROTECTION BUND
E.G.L

| | | |



NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

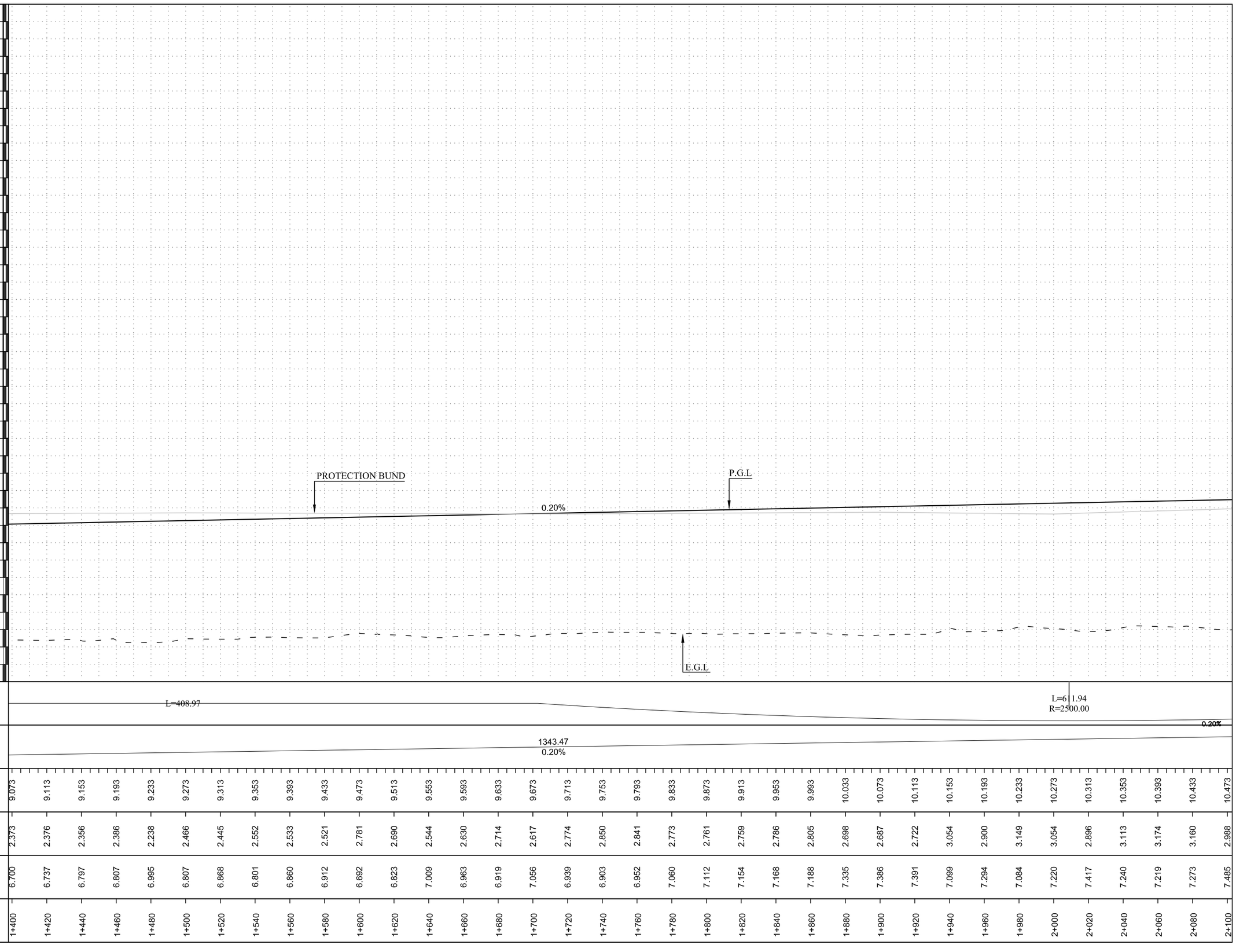
DRAWING TITLE:

PROFILE AT
KM 0+700 TO 1+400

DESIGN BY: AYESHA SHABBIR	SHEET NO: 02 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/01



CHAINAGE	L. DIFF.	E.G.L.	P.G.L.
1+400	6.700	2.373	9.073
1+420	6.737	2.376	9.113
1+440	6.797	2.356	9.153
1+460	6.807	2.386	9.193
1+480	6.995	2.238	9.233
1+500	6.807	2.466	9.273
1+520	6.868	2.445	9.313
1+540	6.801	2.552	9.353
1+560	6.860	2.533	9.393
1+580	6.912	2.521	9.433
1+600	6.692	2.781	9.473
1+620	6.823	2.690	9.513
1+640	7.009	2.544	9.553
1+660	6.963	2.630	9.593
1+680	6.919	2.714	9.633
1+700	7.056	2.617	9.673
1+720	6.939	2.774	9.713
1+740	6.903	2.850	9.753
1+760	6.952	2.841	9.793
1+780	7.060	2.773	9.833
1+800	7.112	2.761	9.873
1+820	7.154	2.759	9.913
1+840	7.168	2.786	9.953
1+860	7.188	2.805	9.993
1+880	7.335	2.698	10.033
1+900	7.386	2.687	10.073
1+920	7.391	2.722	10.113
1+940	7.099	3.054	10.153
1+960	7.294	2.900	10.193
1+980	7.084	3.149	10.233
2+000	7.220	3.054	10.273
2+020	7.417	2.896	10.313
2+040	7.240	3.113	10.353
2+060	7.219	3.174	10.393
2+080	7.273	3.160	10.433
2+100	7.485	2.988	10.473

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

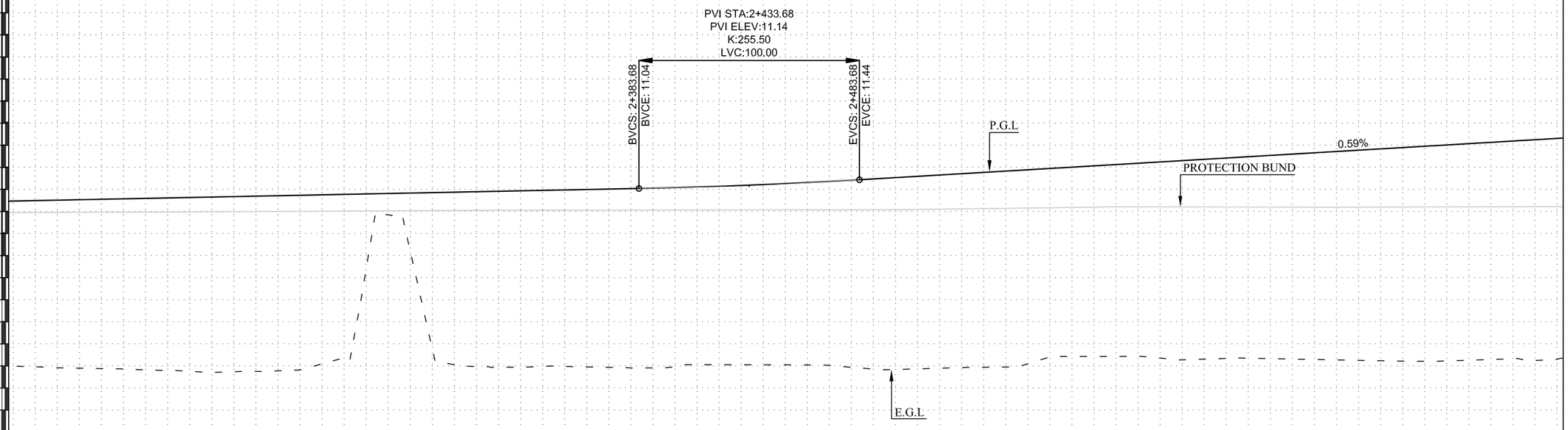
DRAWING TITLE:

PROFILE AT
KM 1+400 TO 2+100

DESIGN BY: AYESHA SHABBIR	SHEET NO: 03 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/02



CHAINAGE	L. DIFF.	E.G.L.	P.G.L.
2+100	7.485	2.988	10.473
2+120	7.601	2.912	10.513
2+140	7.674	2.879	10.553
2+160	7.773	2.820	10.593
2+180	7.879	2.755	10.633
2+200	7.935	2.738	10.673
2+220	7.939	2.774	10.713
2+240	7.661	3.092	10.753
2+260	3.398	7.395	10.793
2+280	2.635	8.198	10.833
2+300	7.823	3.050	10.873
2+320	7.975	2.939	10.913
2+340	7.978	2.976	10.953
2+360	8.037	2.956	10.993
2+380	8.125	2.909	11.033
2+400	8.089	2.989	11.078
2+420	8.087	3.052	11.139
2+440	8.168	3.048	11.215
2+460	8.264	3.043	11.307
2+480	8.478	2.937	11.415
2+500	8.697	2.836	11.533
2+520	8.756	2.895	11.651
2+540	8.831	2.938	11.769
2+560	8.791	3.096	11.888
2+580	8.576	3.430	12.006
2+600	8.692	3.432	12.124
2+620	8.887	3.355	12.242
2+640	9.054	3.306	12.361
2+660	9.131	3.348	12.479
2+680	9.288	3.310	12.597
2+700	9.444	3.271	12.716
2+720	9.601	3.233	12.834
2+740	9.744	3.208	12.952
2+760	9.812	3.259	13.070
2+780	9.864	3.325	13.189
2+800	10.005	3.302	13.307

V.C.D.: 100.00 / 25550.14 ; 447.95 / 0.59%

H.C.D.

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
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BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

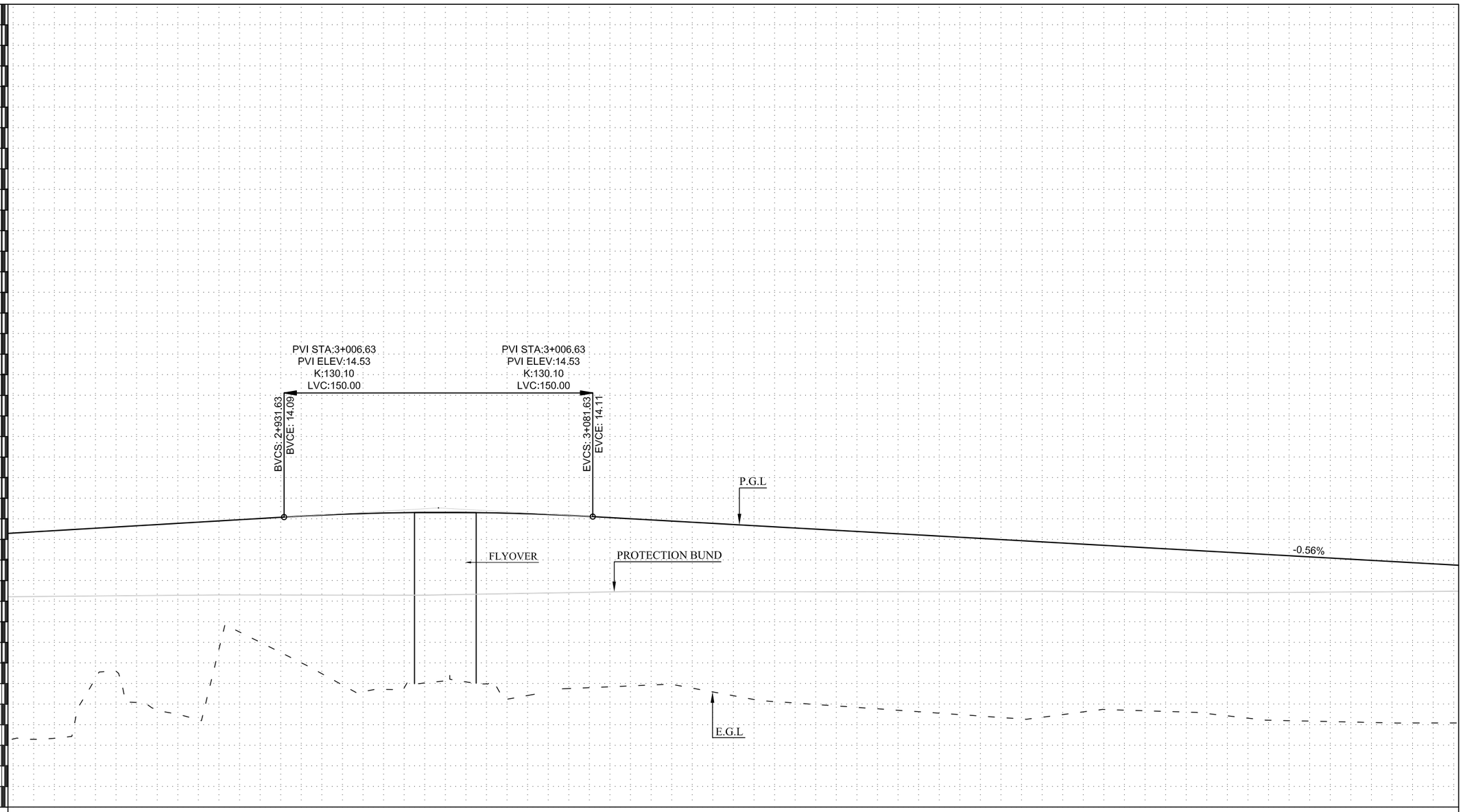
DRAWING TITLE:

PROFILE AT
KM 2+100 TO 2+800

DESIGN BY: AYESHA SHABBIR	SHEET NO: 04 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/03



L=1066.92

V.C.D		13009.52 150.00	695.58 -0.56%

CHAINAGE	P.G.L.	E.G.L.	L. DIFF.
2+800	13.307	3.302	10.005
2+820	13.425	3.340	10.086
2+840	13.543	6.253	7.290
2+860	13.662	5.077	8.585
2+880	13.780	4.513	9.267
2+900	13.898	7.676	6.222
2+920	14.017	8.005	6.011
2+940	14.132	7.007	7.125
2+960	14.222	5.927	8.295
2+980	14.281	5.712	8.570
3+000	14.310	6.029	8.281
3+020	14.308	6.079	8.229
3+040	14.275	5.238	9.036
3+060	14.211		
3+080	14.117	5.799	8.318
3+100	14.004	5.886	8.119
3+120	13.892	5.959	7.933
3+140	13.780	5.591	8.189
3+160	13.667	5.223	8.445
3+180	13.555	5.052	8.503
3+200	13.443	4.912	8.531
3+220	13.331	4.771	8.559
3+240	13.218	4.630	8.588
3+260	13.106	4.490	8.616
3+280	12.994	4.349	8.644
3+300	12.881	4.363	8.519
3+320	12.769	4.621	8.148
3+340	12.657	4.707	7.950
3+360	12.544	4.644	7.900
3+380	12.432	4.542	7.890
3+400	12.320	4.317	8.003
3+420	12.207	4.195	8.013
3+440	12.095	4.151	7.944
3+460	11.983	4.108	7.874
3+480	11.870	4.083	7.787
3+500	11.758	4.086	7.672

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

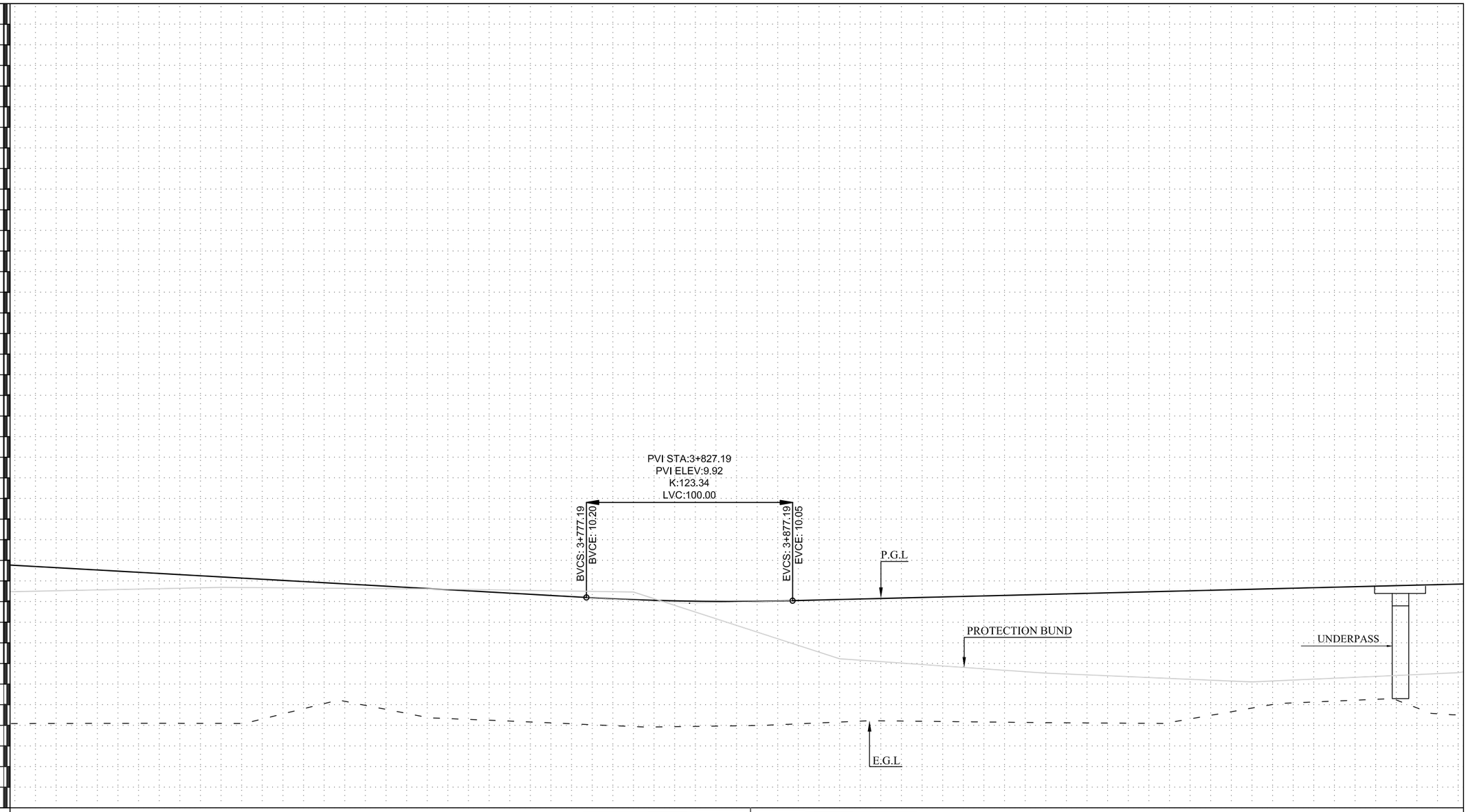
DRAWING TITLE:

PROFILE AT
KM 2+800 TO 3+500

DESIGN BY: AYESHA SHABBIR	SHEET NO: 05 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/04



H.C.D.	L=950.02 R=800.00
V.C.D.	100.00 12333.72

CHAINAGE	P.G.L.	E.G.L.	L. DIFF.
3+500	11.758	4.086	7.672
3+520	11.646	4.089	7.557
3+540	11.533	4.092	7.441
3+560	11.421	4.096	7.325
3+580	11.309	4.096	7.213
3+600	11.196	4.092	7.104
3+620	11.084	4.305	6.779
3+640	10.972	4.803	6.168
3+660	10.859	5.166	5.693
3+680	10.747	4.774	5.973
3+700	10.635	4.383	6.252
3+720	10.522	4.288	6.235
3+740	10.410	4.207	6.203
3+760	10.298	4.118	6.180
3+780	10.186	4.030	6.156
3+800	10.094	3.942	6.152
3+820	10.035	3.935	6.100
3+840	10.008	3.963	6.046
3+860	10.014	3.991	6.023
3+880	10.052	4.071	5.981
3+900	10.102	4.159	5.943
3+920	10.152	4.218	5.934
3+940	10.202	4.196	6.006
3+960	10.251	4.174	6.078
3+980	10.301	4.152	6.149
4+000	10.351	4.130	6.221
4+020	10.401	4.116	6.285
4+040	10.451	4.103	6.348
4+060	10.501	4.135	6.365
4+080	10.550	4.485	6.066
4+100	10.600	4.836	5.764
4+120	10.650	5.088	5.562
4+140	10.700	5.175	5.525
4+160	10.750	5.263	5.487
4+180	10.800	4.844	5.956
4+200	10.849	4.509	6.341

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

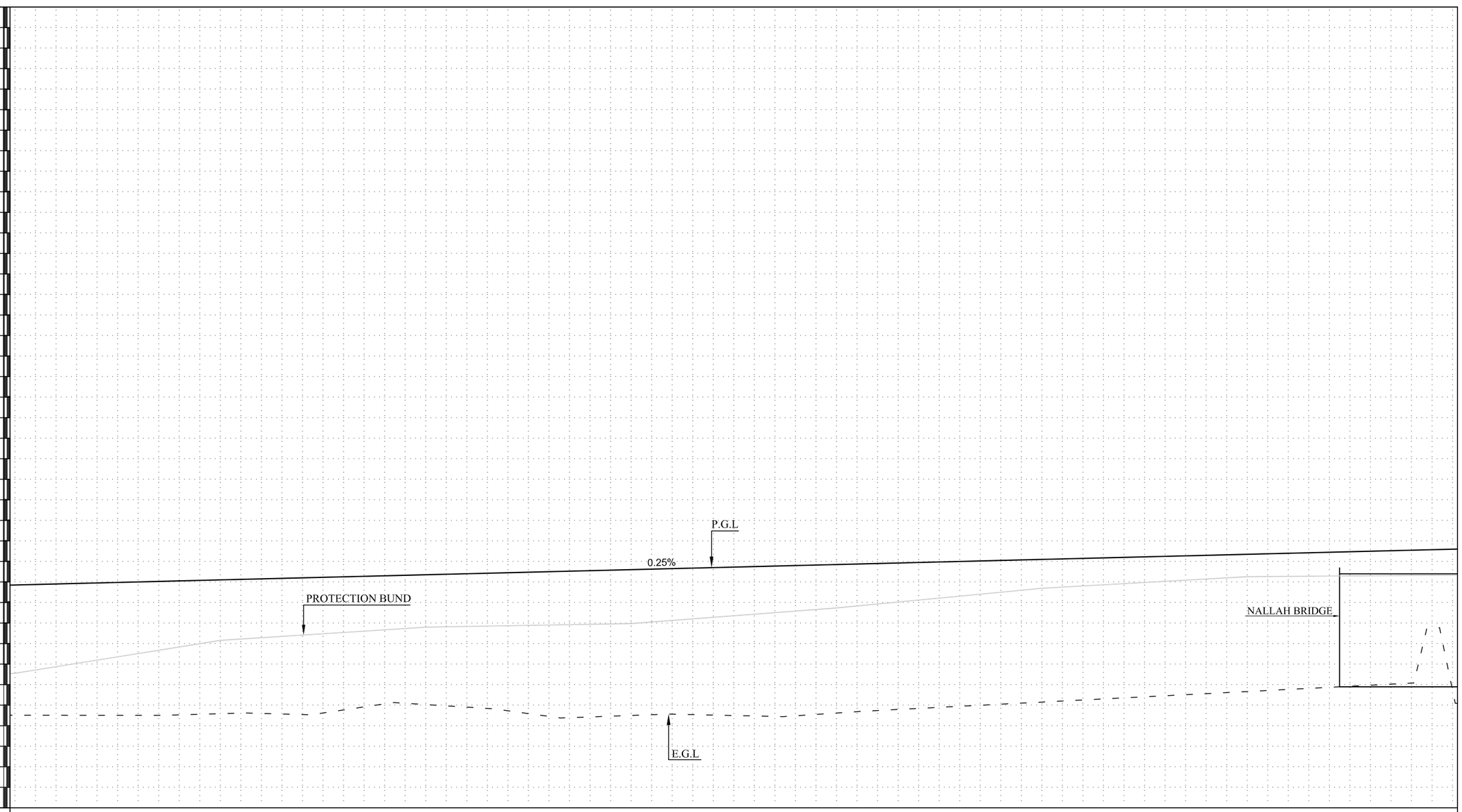
DRAWING TITLE:

PROFILE AT
KM 3+500 TO 4+200

DESIGN BY: AYESHA SHABBIR	SHEET NO: 06 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/05



	CHAINAGE	L. DIFF.	E.G.L.	P.G.L.
	4+200	6.341	4.509	10.849
	4+220	6.392	4.507	10.899
	4+240	6.444	4.505	10.949
	4+260	6.495	4.504	10.999
	4+280	6.522	4.527	11.049
	4+300	6.515	4.584	11.099
	4+320	6.553	4.596	11.148
	4+340	6.657	4.541	11.198
	4+360	6.481	4.767	11.248
	4+380	6.235	5.063	11.298
	4+400	6.318	5.030	11.348
	4+420	6.493	4.904	11.398
	4+440	6.721	4.726	11.447
	4+460	7.045	4.452	11.497
	4+480	7.121	4.426	11.547
	4+500	7.098	4.498	11.597
	4+520	7.086	4.561	11.647
	4+540	7.180	4.517	11.697
	4+560	7.274	4.472	11.746
	4+580	7.316	4.480	11.796
	4+600	7.231	4.615	11.846
	4+620	7.157	4.739	11.896
	4+640	7.104	4.841	11.946
	4+660	7.051	4.944	11.996
	4+680	6.999	5.047	12.045
	4+700	6.946	5.149	12.095
	4+720	6.893	5.252	12.145
	4+740	6.840	5.355	12.195
	4+760	6.787	5.458	12.245
	4+780	6.734	5.560	12.295
	4+800	6.682	5.663	12.344
	4+820	6.629	5.766	12.394
	4+840	6.576	5.868	12.444
	4+860	6.523	5.971	12.494
	4+880	6.470	6.074	12.544
	4+900	6.860	5.734	12.594

V.C.D.: 1275.49 / 0.25%

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

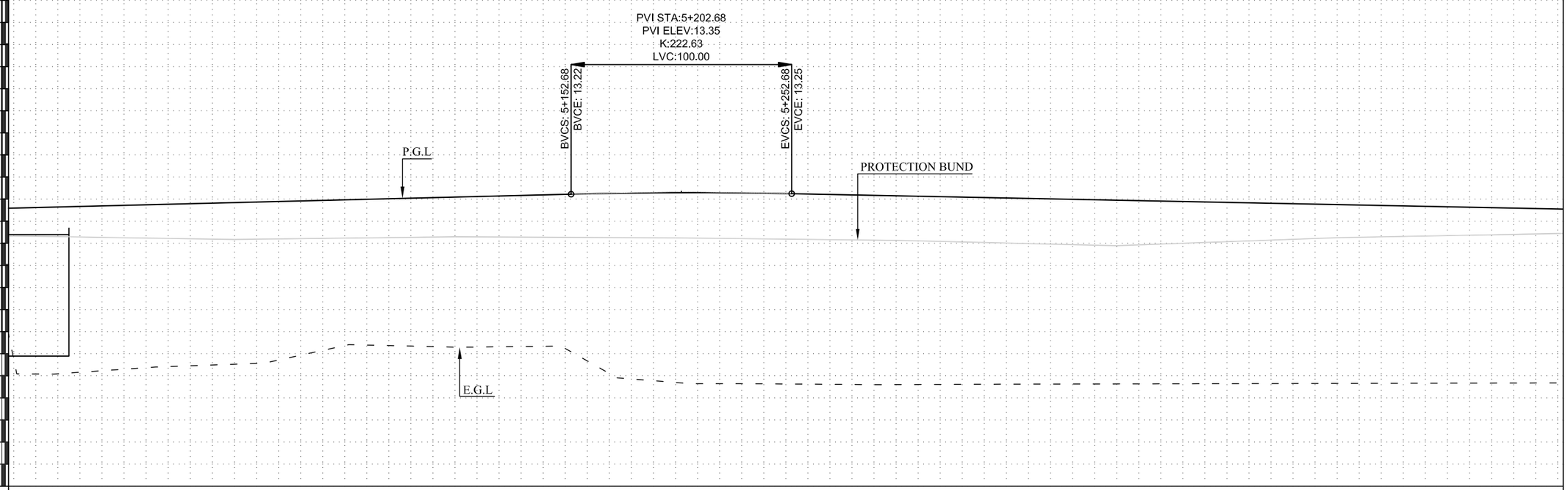
DRAWING TITLE:

PROFILE AT
KM 4+200 TO 4+900

DESIGN BY: AYESHA SHABBIR	SHEET NO: 07 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/06



NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

DRAWING TITLE:

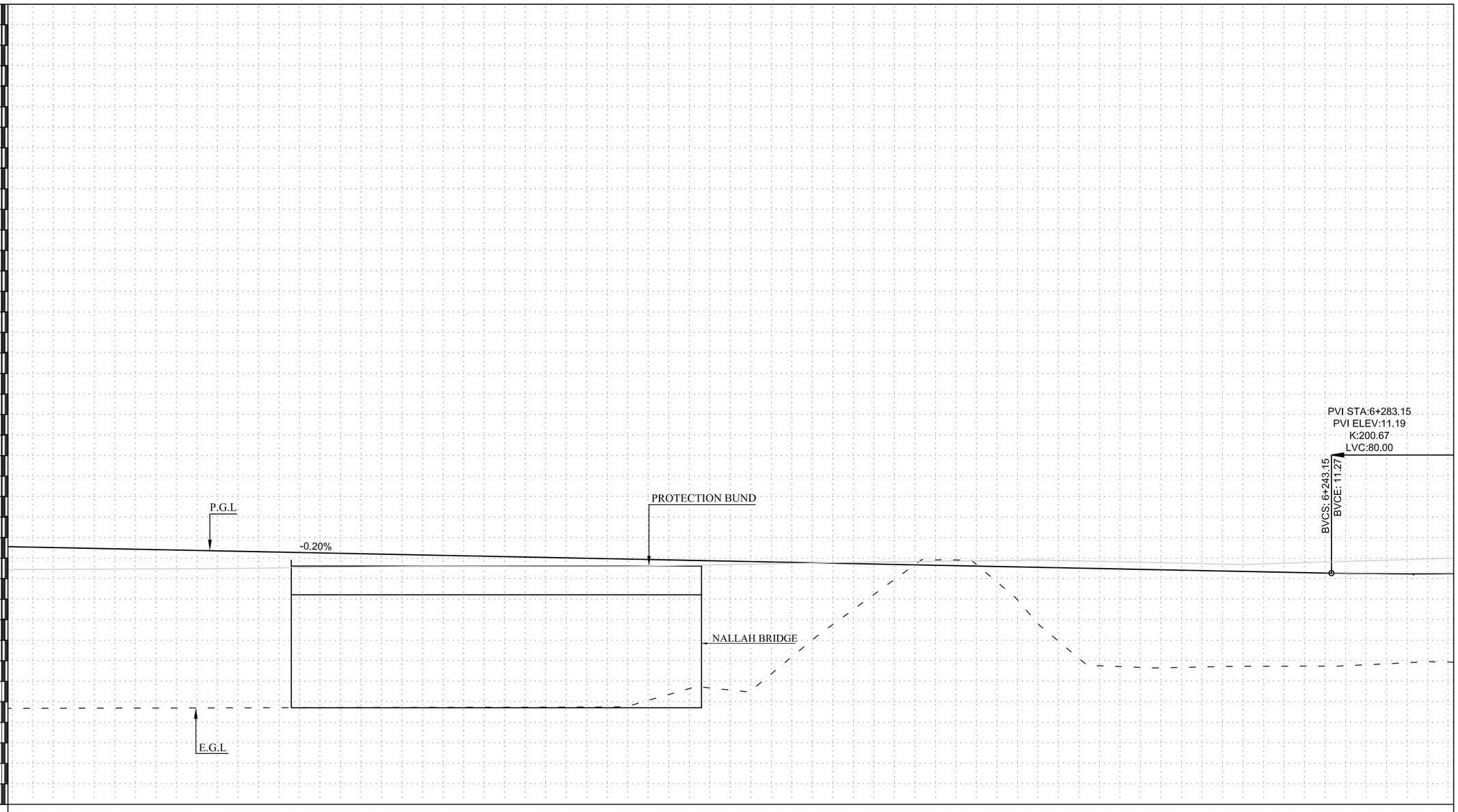
PROFILE AT
KM 4+900 TO 5+600

DESIGN BY: AYESHA SHABBIR	SHEET NO: 08 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

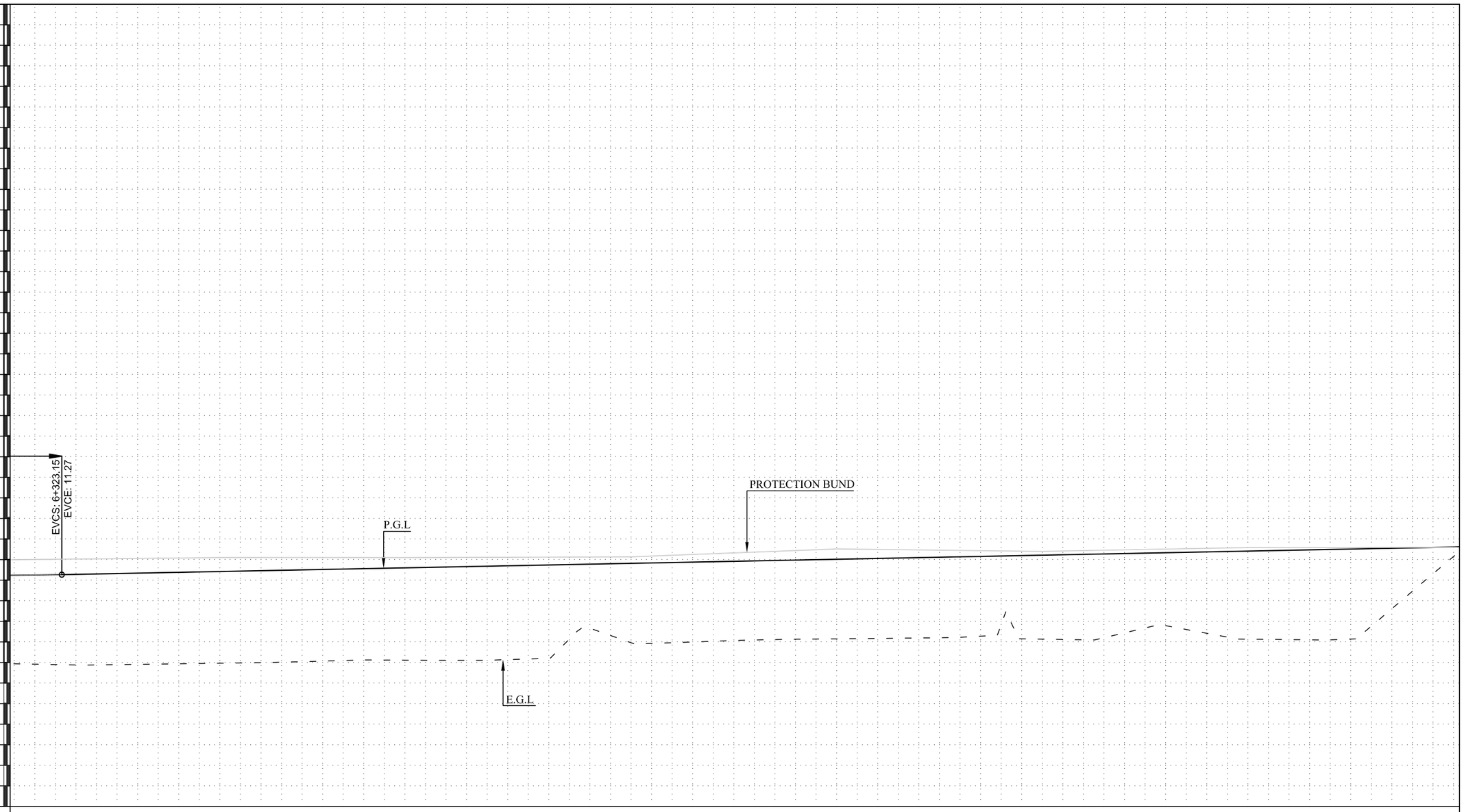
CAD FILE NAME:

ZI-LOYA/MALIR/PR/07

CHAINAGE	L. DIFF.	E.G.L.	P.G.L.	V.C.D.	H.C.D.
4+900	6.860	5.734	12.594		
4+920	7.552	5.091	12.643		
4+940	7.463	5.230	12.693		
4+960	7.375	5.368	12.743		
4+980	7.339	5.454	12.793		
5+000	7.318	5.525	12.843		
5+020	7.179	5.714	12.893		
5+040	6.791	6.151	12.942		
5+060	6.599	6.393	12.992		
5+080	6.696	6.346	13.042		
5+100	6.792	6.300	13.092		
5+120	6.827	6.314	13.142		
5+140	6.855	6.337	13.192		
5+160	7.567	5.673	13.240	22263.27	
5+180	8.417	4.857	13.274	100.00	
5+200	8.591	4.700	13.291		
5+220	8.647	4.642	13.289		
5+240	8.633	4.636	13.270		
5+260	8.611	4.622	13.233		
5+280	8.585	4.608	13.193		
5+300	8.550	4.603	13.153		
5+320	8.503	4.610	13.113		
5+340	8.456	4.617	13.073		
5+360	8.410	4.623	13.033		
5+380	8.365	4.628	12.993		
5+400	8.321	4.632	12.953		
5+420	8.276	4.637	12.913		
5+440	8.232	4.641	12.873		
5+460	8.187	4.646	12.833		
5+480	8.143	4.650	12.793		
5+500	8.098	4.655	12.753		
5+520	8.054	4.660	12.713		
5+540	8.009	4.664	12.673		
5+560	7.964	4.669	12.633		
5+580	7.920	4.673	12.593		
5+600	7.875	4.678	12.553		


PVI STA:6+283.15
PVI ELEV:11.19
K:200.67
LVC:80.00
BVCS: 6+243.15
BVCE: 11.27
P.G.L
~0.20%
PROTECTION BUND
NALLAH BRIDGE
E.G.L

| | | |



CHAINAGE	L. DIFF.	E.G.L.	P.G.L.	V.C.D.	H.C.D.
6+300	4.301	6.933	11.234		
6+320	4.366	6.895	11.260		
6+340	4.420	6.880	11.300		
6+360	4.434	6.905	11.340		
6+380	4.448	6.932	11.379		
6+400	4.459	6.960	11.419		
6+420	4.468	6.991	11.459		
6+440	4.464	7.034	11.498		
6+460	4.446	7.092	11.538		
6+480	4.463	7.115	11.578		
6+500	4.514	7.104	11.618		
6+520	4.554	7.103	11.657		
6+540	4.561	7.136	11.697		
6+560	4.539	7.198	11.737		
6+580	3.114	8.662	11.777		
6+600	3.859	7.957	11.816		
6+620	3.898	7.958	11.856		
6+640	3.868	8.028	11.896		
6+660	3.845	8.091	11.936		
6+680	3.845	8.130	11.975		
6+700	3.869	8.146	12.015		
6+720	3.887	8.167	12.055		
6+740	3.906	8.188	12.094		
6+760	3.913	8.222	12.134		
6+780	3.336	8.837	12.174		
6+800	4.082	8.132	12.214		
6+820	4.153	8.100	12.253		
6+840	3.855	8.438	12.293		
6+860	3.547	8.786	12.333		
6+880	3.956	8.417	12.373		
6+900	4.281	8.131	12.412		
6+920	4.342	8.110	12.452		
6+940	4.396	8.096	12.492		
6+960	3.772	8.759	12.532		
6+980	2.110	10.461	12.571		
7+000	0.462	12.149	12.611		

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

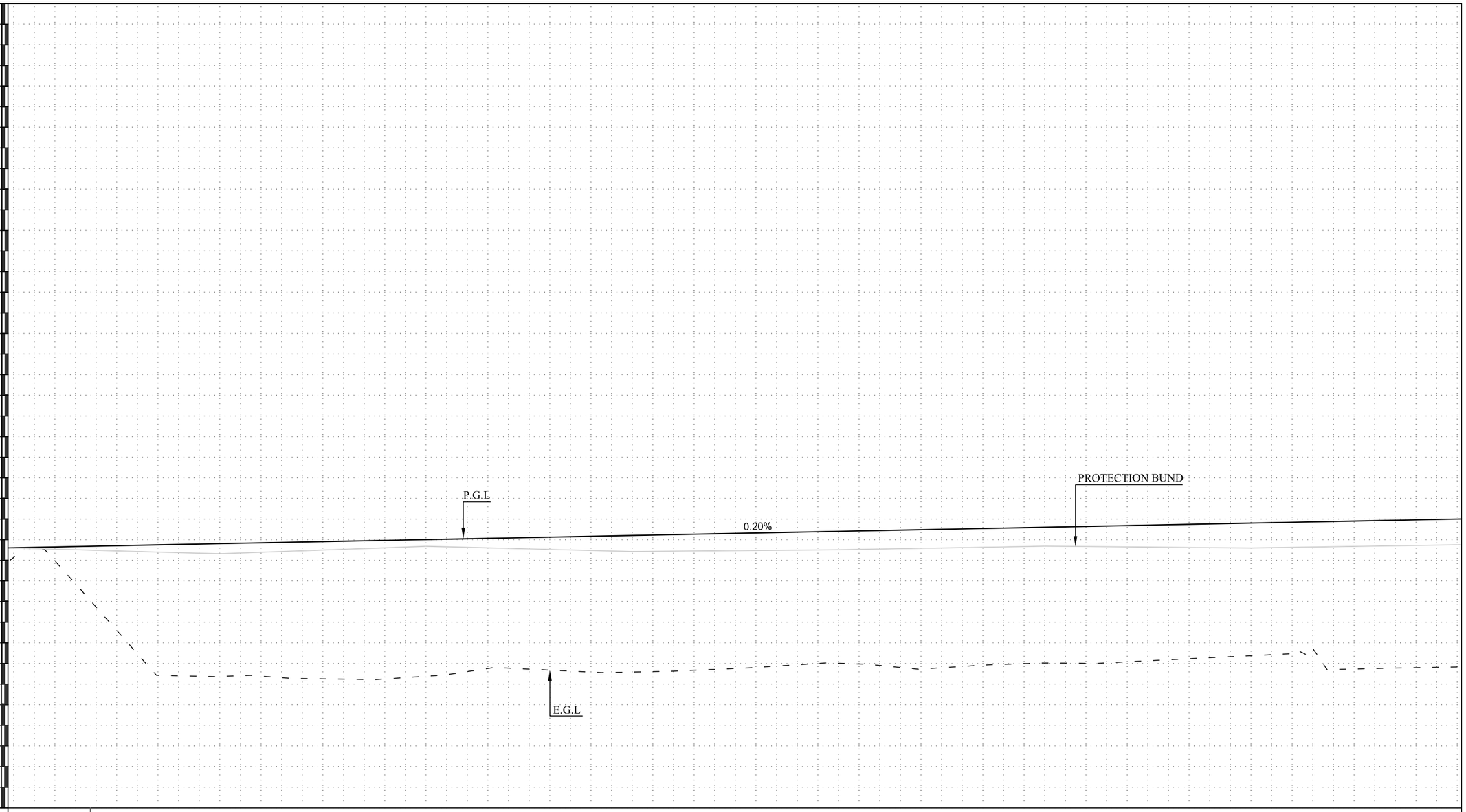
DRAWING TITLE:

PROFILE AT
KM 6+300 TO 7+000

DESIGN BY: AYESHA SHABBIR	SHEET NO: 10 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/09



CHAINAGE	L. DIFF.	E.G.L.	P.G.L.	V.C.D.	H.C.D.
7+000	0.462	12.149	12.611		
7+020	0.675	11.975	12.651		
7+040	2.960	9.730	12.690		
7+060	5.261	7.469	12.730		
7+080	6.366	6.404	12.770		
7+100	6.438	6.372	12.810		
7+120	6.463	6.386	12.849		
7+140	6.622	6.267	12.889		
7+160	6.690	6.239	12.929		
7+180	6.720	6.249	12.969		
7+200	6.627	6.382	13.008		
7+220	6.441	6.607	13.048		
7+240	6.317	6.771	13.088		
7+260	6.450	6.678	13.128		
7+280	6.583	6.584	13.167		
7+300	6.620	6.587	13.207		
7+320	6.620	6.627	13.247		
7+340	6.574	6.712	13.286		
7+360	6.519	6.807	13.326		
7+380	6.429	6.937	13.366		
7+400	6.392	7.014	13.406		
7+420	6.542	6.903	13.445		
7+440	6.759	6.727	13.485		
7+460	6.671	6.854	13.525		
7+480	6.607	6.957	13.565		
7+500	6.582	7.022	13.604		
7+520	6.634	7.010	13.644		
7+540	6.604	7.079	13.684		
7+560	6.545	7.178	13.724		
7+580	6.487	7.277	13.763		
7+600	6.428	7.375	13.803		
7+620	6.369	7.474	13.843		
7+640	7.176	6.707	13.882		
7+660	7.170	6.752	13.922		
7+680	7.170	6.792	13.962		
7+700	7.174	6.828	14.002		

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT
DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES
(DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

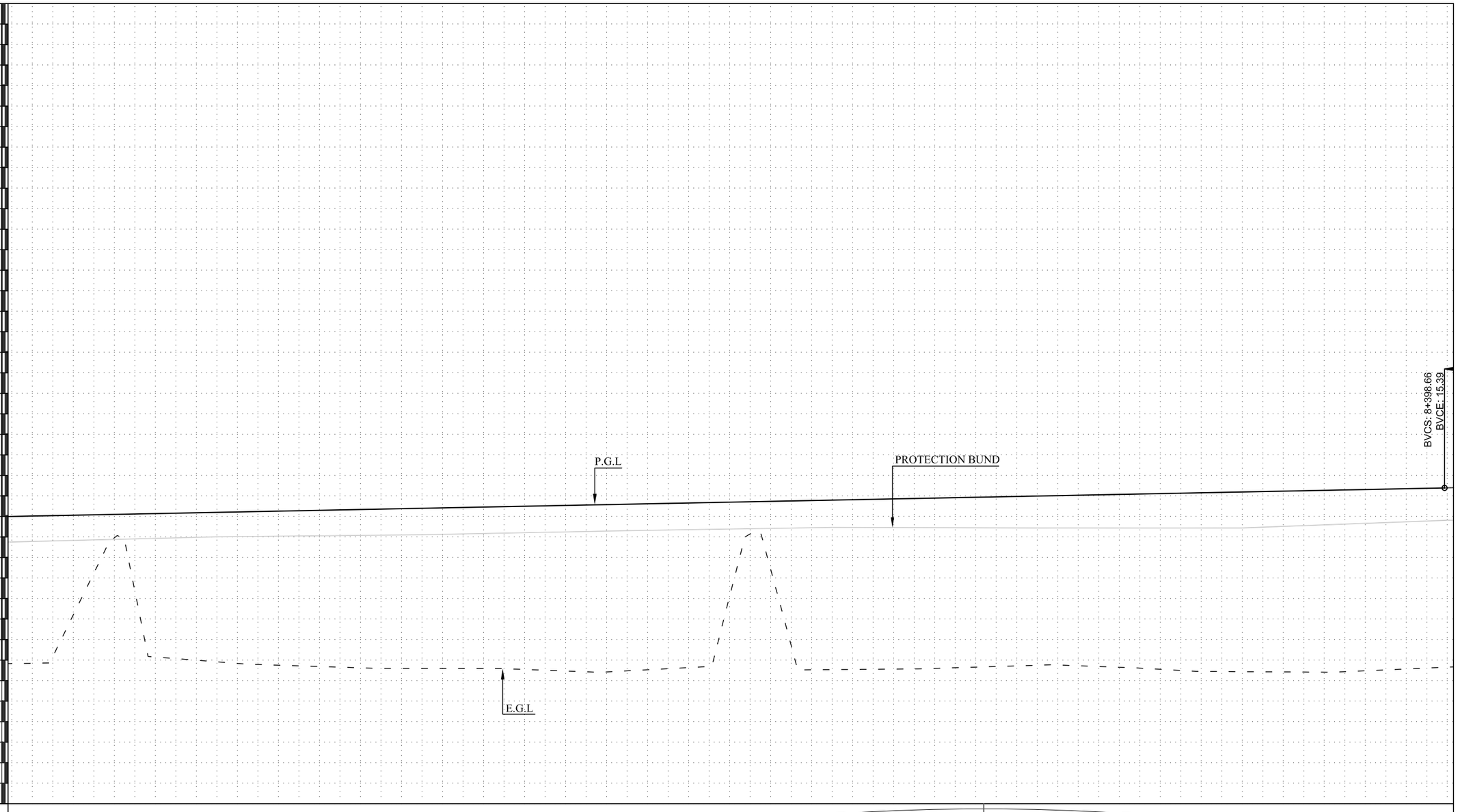
DRAWING TITLE:

PROFILE AT
KM 7+000 TO 7+700

DESIGN BY: AYESHA SHABBIR	SHEET NO: 11 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/10



H.C.D.

L=239.64
R=7000.00

V.C.D.

CHAINAGE	L. DIFF.	E.G.L.	P.G.L.
7+700	7.174	6.828	14.002
7+720	6.863	7.178	14.041
7+740	2.835	11.246	14.081
7+760	3.768	10.353	14.121
7+780	7.090	7.071	14.161
7+800	7.285	6.916	14.200
7+820	7.457	6.783	14.240
7+840	7.561	6.719	14.280
7+860	7.666	6.654	14.320
7+880	7.763	6.596	14.359
7+900	7.807	6.592	14.399
7+920	7.852	6.587	14.439
7+940	7.898	6.580	14.479
7+960	8.014	6.504	14.518
7+980	8.130	6.428	14.558
8+000	8.124	6.473	14.598
8+020	8.058	6.579	14.637
8+040	7.992	6.686	14.677
8+060	1.568	13.149	14.717
8+080	7.035	7.721	14.757
8+100	8.262	6.534	14.796
8+120	8.284	6.552	14.836
8+140	8.307	6.569	14.876
8+160	8.289	6.626	14.916
8+180	8.268	6.687	14.955
8+200	8.247	6.748	14.995
8+220	8.311	6.724	15.035
8+240	8.426	6.648	15.075
8+260	8.563	6.551	15.114
8+280	8.707	6.447	15.154
8+300	8.758	6.435	15.194
8+320	8.810	6.423	15.233
8+340	8.862	6.411	15.273
8+360	8.836	6.477	15.313
8+380	8.787	6.566	15.353
8+400	8.739	6.654	15.392

NOTES

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2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

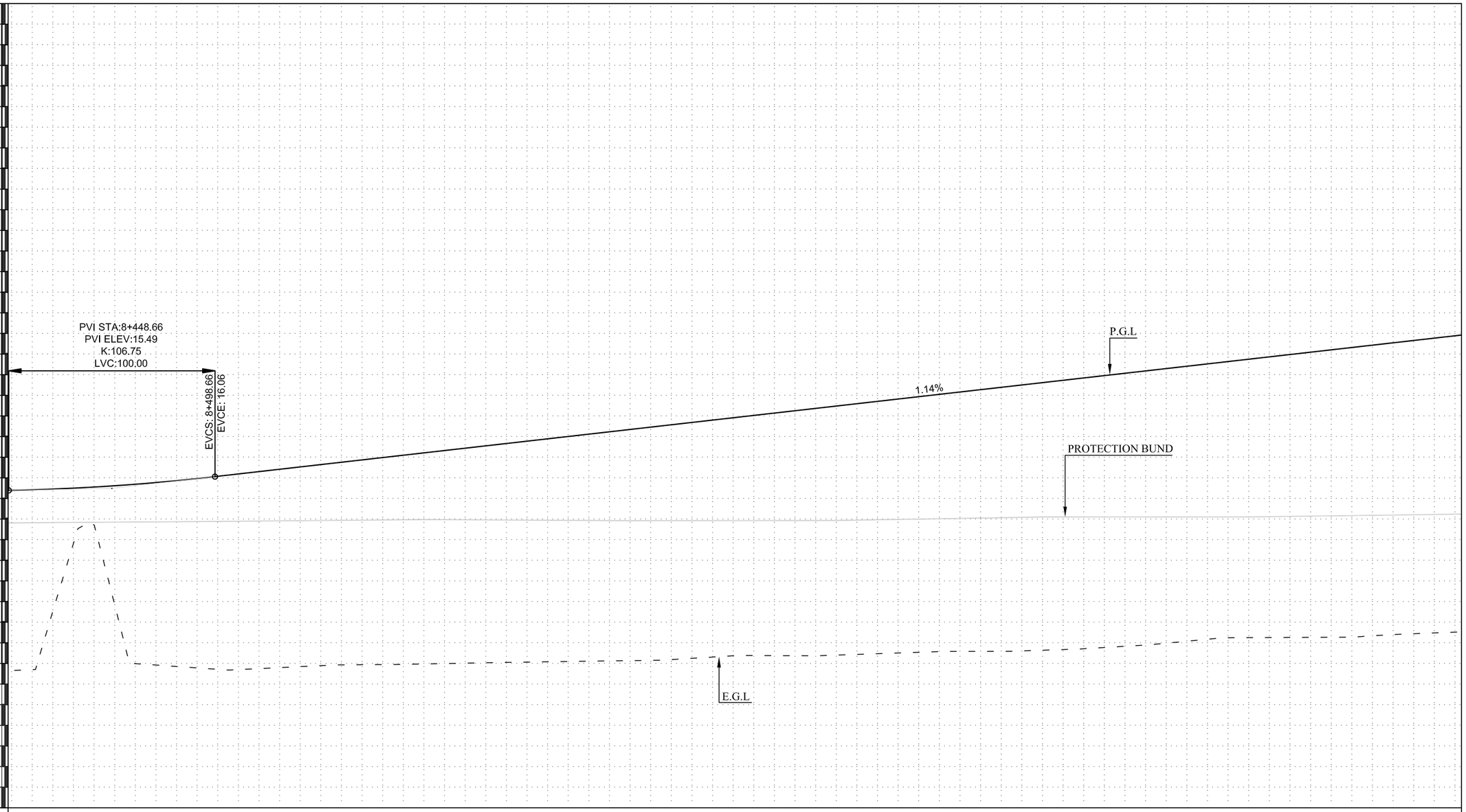
DRAWING TITLE:

PROFILE AT
KM 7+700 TO 8+400

DESIGN BY: AYESHA SHABBIR	SHEET NO: 12 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/11



CHAINAGE	L. DIFF.	E.G.L.	P.G.L.
8+400	8.739	6.654	15.392
8+420	5.931	9.523	15.453
8+440	1.838	13.714	15.552
8+460	8.697	6.991	15.688
8+480	9.009	6.852	15.861
8+500	9.359	6.713	16.072
8+520	9.551	6.748	16.299
8+540	9.681	6.845	16.526
8+560	9.823	6.930	16.753
8+580	10.038	6.942	16.980
8+600	10.234	6.974	17.207
8+620	10.422	7.012	17.434
8+640	10.614	7.048	17.662
8+660	10.811	7.078	17.889
8+680	11.008	7.108	18.116
8+700	11.207	7.135	18.343
8+720	11.384	7.186	18.570
8+740	11.488	7.309	18.797
8+760	11.642	7.382	19.024
8+780	11.877	7.375	19.251
8+800	12.075	7.403	19.478
8+820	12.234	7.472	19.705
8+840	12.392	7.540	19.932
8+860	12.577	7.582	20.159
8+880	12.801	7.585	20.387
8+900	12.975	7.639	20.614
8+920	13.129	7.712	20.841
8+940	13.236	7.832	21.068
8+960	13.315	7.980	21.295
8+980	13.350	8.172	21.522
9+000	13.499	8.250	21.749
9+020	13.716	8.260	21.976
9+040	13.934	8.269	22.203
9+060	14.093	8.338	22.430
9+080	14.218	8.440	22.657
9+100	14.367	8.518	22.884

V.C.D.: 100.00 / 10675.26 — 693.78 / 1.14%

H.C.D.: L=1297.23

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
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BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:
MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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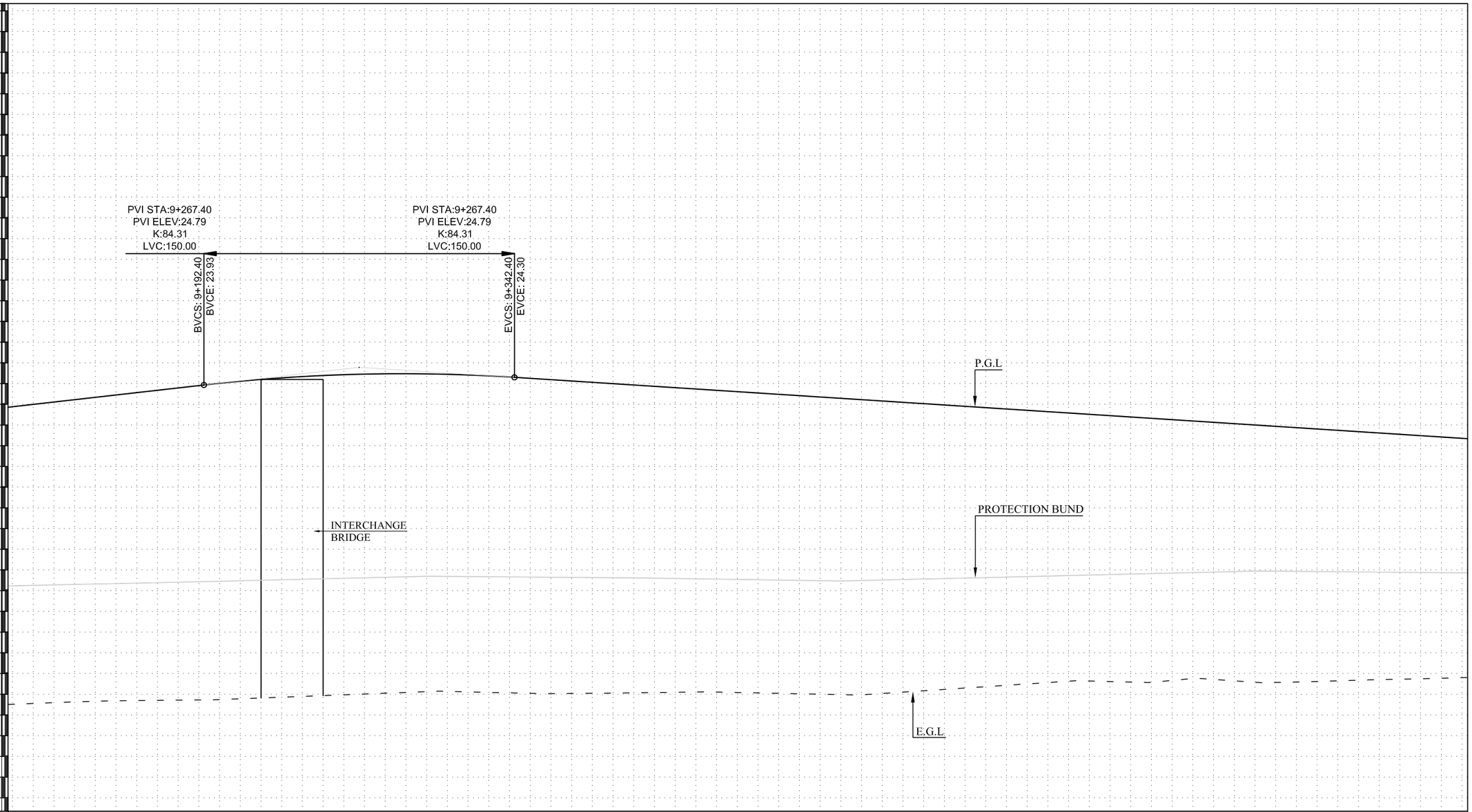
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

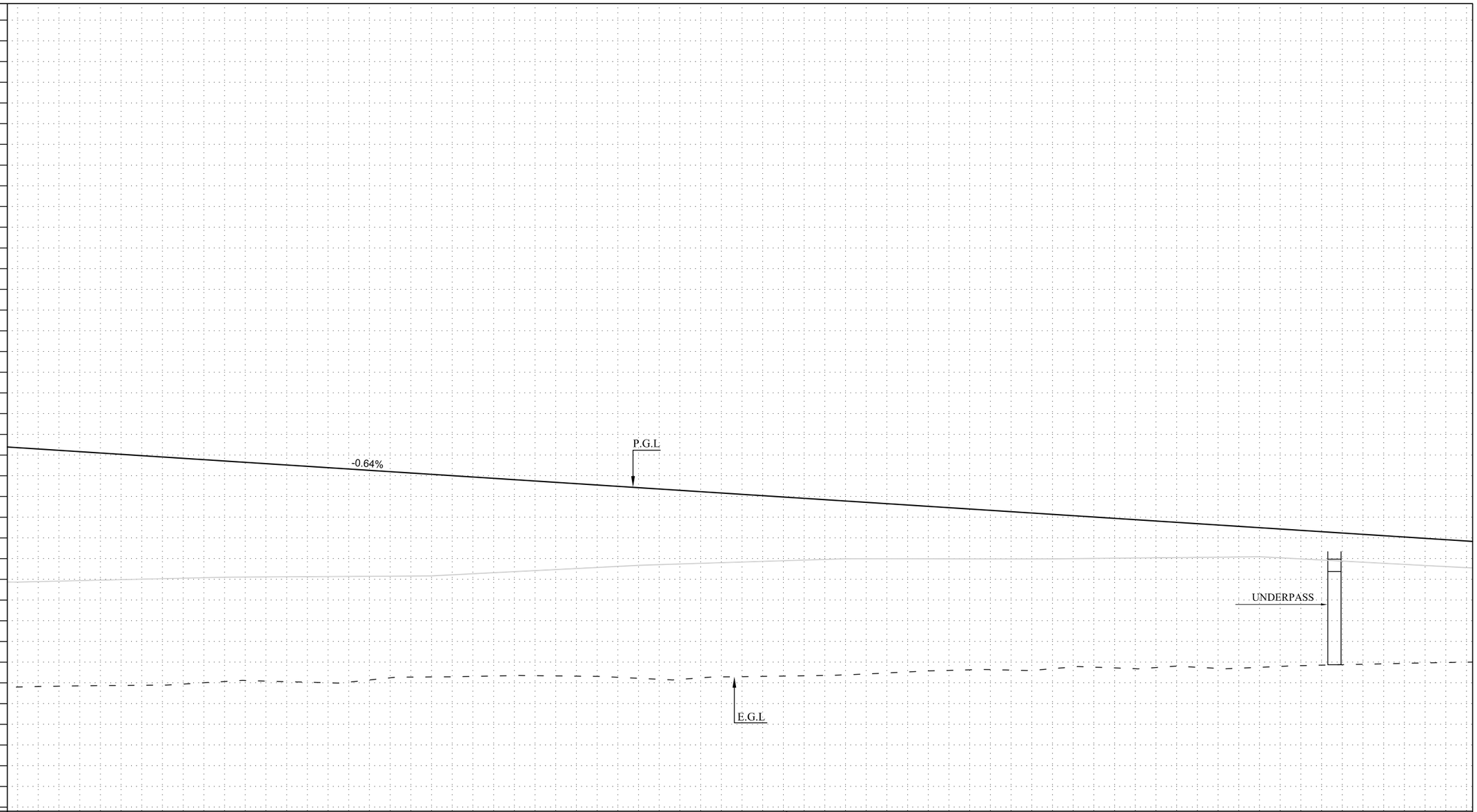
DRAWING TITLE:
PROFILE AT
KM 8+400 TO 9+100

DESIGN BY: AYESHA SHABBIR	SHEET NO: 13 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:
ZI-LOYA/MALIR/PR/12


PVI STA:9+267.40
PVI ELEV:24.79
K:84.31
LVC:150.00
BVCS: 9+192.40
BVCE: 23.93
PVI STA:9+267.40
PVI ELEV:24.79
K:84.31
LVC:150.00
EVCS: 9+342.40
EVCE: 24.30
P.G.L
INTERCHANGE
BRIDGE
PROTECTION BUND
E.G.L

| | | |



CHAINAGE	L. DIFF.	E.G.L.	P.G.L.	V.C.D.	H.C.D.
9+800	11.557	9.799	21.357	1252.88 -0.64%	L=1111.13 R=2000.00
9+820	11.388	9.840	21.228		
9+840	11.231	9.868	21.099		
9+860	11.087	9.884	20.971		
9+880	10.899	9.943	20.842		
9+900	10.647	10.066	20.713		
9+920	10.497	10.087	20.584		
9+940	10.424	10.032	20.456		
9+960	10.291	10.036	20.327		
9+980	9.954	10.244	20.198		
10+000	9.783	10.286	20.069		
10+020	9.627	10.313	19.941		
10+040	9.461	10.351	19.812		
10+060	9.347	10.337	19.683		
10+080	9.239	10.315	19.555		
10+100	9.205	10.221	19.426		
10+120	9.129	10.168	19.297		
10+140	8.880	10.288	19.168		
10+160	8.724	10.315	19.040		
10+180	8.568	10.343	18.911		
10+200	8.392	10.390	18.782		
10+220	8.175	10.478	18.653		
10+240	7.948	10.576	18.525		
10+260	7.765	10.631	18.396		
10+280	7.651	10.616	18.267		
10+300	7.454	10.685	18.138		
10+320	7.250	10.760	18.010		
10+340	7.197	10.684	17.881		
10+360	6.945	10.807	17.752		
10+380	6.922	10.701	17.624		
10+400	6.742	10.753	17.495		
10+420	6.533	10.833	17.366		
10+440	6.360	10.877	17.237		
10+460	6.187	10.921	17.109		
10+480	6.015	10.965	16.980		
10+500	5.851	11.000	16.851		

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

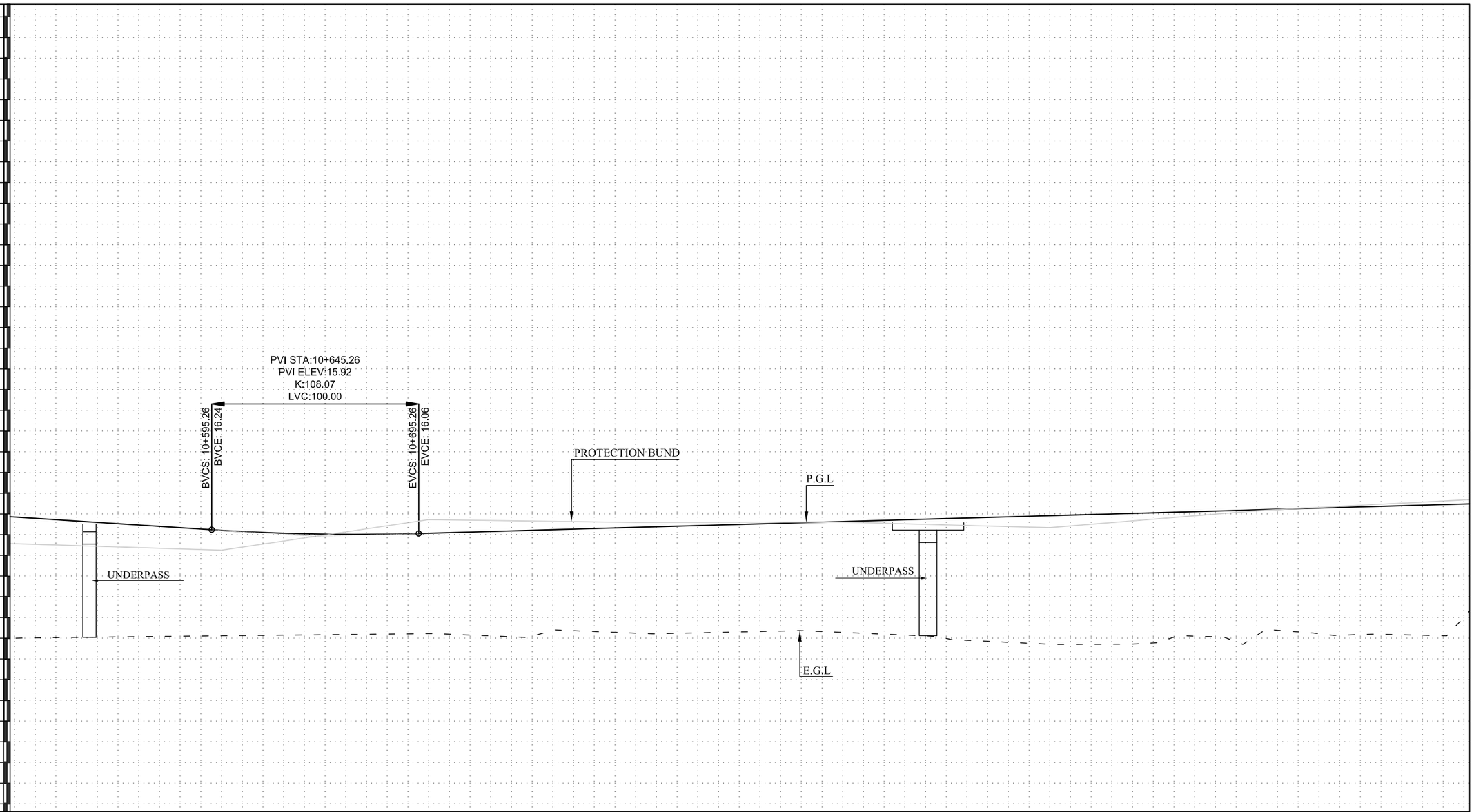
DRAWING TITLE:

PROFILE AT
KM 9+800 TO 10+500

DESIGN BY: AYESHA SHABBIR	SHEET NO: 15 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/14



CHAINAGE	L. DIFF.	E.G.L.	P.G.L.	V.C.D.	H.C.D.
10+500	5.851	11.000	16.851		
10+520	5.693	11.030	16.722		
10+540	5.543	11.051	16.594		
10+560	5.393	11.072	16.465		
10+580	5.243	11.093	16.336		
10+600	5.094	11.114	16.208		
10+620	4.972	11.135	16.107		
10+640	4.886	11.156	16.043		
10+660	4.838	11.177	16.015		
10+680	4.826	11.198	16.025		
10+700	4.851	11.220	16.070	100.00 10807.46	
10+720	4.975	11.151	16.127		
10+740	5.117	11.066	16.183		
10+760	4.858	11.382	16.239		
10+780	4.972	11.323	16.296		
10+800	5.108	11.244	16.352		
10+820	5.172	11.236	16.408		
10+840	5.184	11.281	16.464		
10+860	5.196	11.325	16.521		
10+880	5.212	11.365	16.577		
10+900	5.354	11.279	16.633		
10+920	5.496	11.194	16.690		
10+940	5.638	11.108	16.746		
10+960	5.901	10.902	16.802		
10+980	6.053	10.806	16.859		
11+000	6.205	10.710	16.915		
11+020	6.266	10.705	16.971		
11+040	6.312	10.716	17.028		
11+060	6.030	11.054	17.084		
11+080	6.075	11.065	17.140		
11+100	6.058	11.139	17.197		
11+120	5.949	11.304	17.253		
11+140	6.166	11.144	17.309		
11+160	6.175	11.191	17.366		
11+180	6.280	11.142	17.422		
11+200	5.465	12.013	17.478		

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
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4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
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ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
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EVCE.	END OF VERTICAL CURVE ELEVATION
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ELEV.	ELEVATION
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K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
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Ph: 051-4938213-4, FAX: 051-4938215

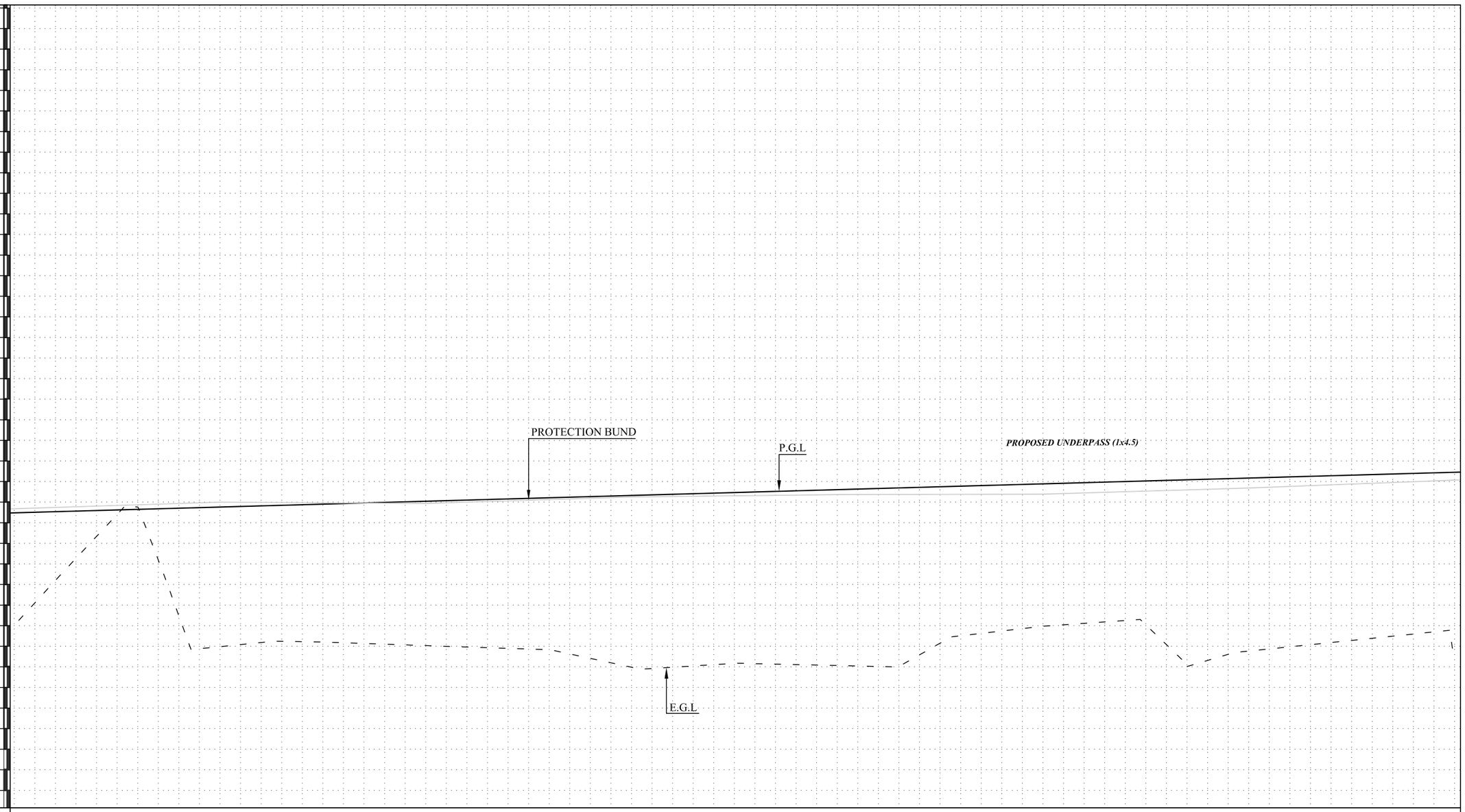
DRAWING TITLE:

PROFILE AT
KM 10+500 TO 11+200

DESIGN BY:	SHEET NO:
AYESHA SHABBIR	16 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/15



CHAINAGE	L. DIFF.	E.G.L.	P.G.L.	V.C.D.	H.C.D.
11+200	5.465	12.013	17.478		
11+220	3.340	14.195	17.535		
11+240	1.257	16.334	17.591		
11+260	-0.115	17.763	17.647		
11+280	5.219	12.484	17.704		
11+300	6.780	10.980	17.760		
11+320	6.636	11.180	17.816		
11+340	6.650	11.222	17.873		
11+360	6.757	11.172	17.929		
11+380	6.883	11.102	17.985		
11+400	7.010	11.032	18.041		
11+420	7.136	10.962	18.098		
11+440	7.257	10.897	18.154		
11+460	7.377	10.833	18.210		
11+480	7.855	10.412	18.267		
11+500	8.341	9.982	18.323		
11+520	8.399	9.981	18.379		
11+540	8.330	10.106	18.436		
11+560	8.337	10.155	18.492		
11+580	8.439	10.110	18.548		
11+600	8.541	10.064	18.605		
11+620	8.643	10.018	18.661		
11+640	8.133	10.585	18.717		
11+660	7.265	11.509	18.774		
11+680	7.090	11.740	18.830		
11+700	6.914	11.972	18.886		
11+720	6.830	12.113	18.943		
11+740	6.747	12.252	18.999		
11+760	7.977	11.078	19.055		
11+780	8.800	10.311	19.112		
11+800	8.401	10.767	19.168		
11+820	8.251	10.974	19.224		
11+840	8.100	11.180	19.281		
11+860	7.950	11.387	19.337		
11+880	7.799	11.594	19.393		
11+900	8.573	10.877	19.449		L=23

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

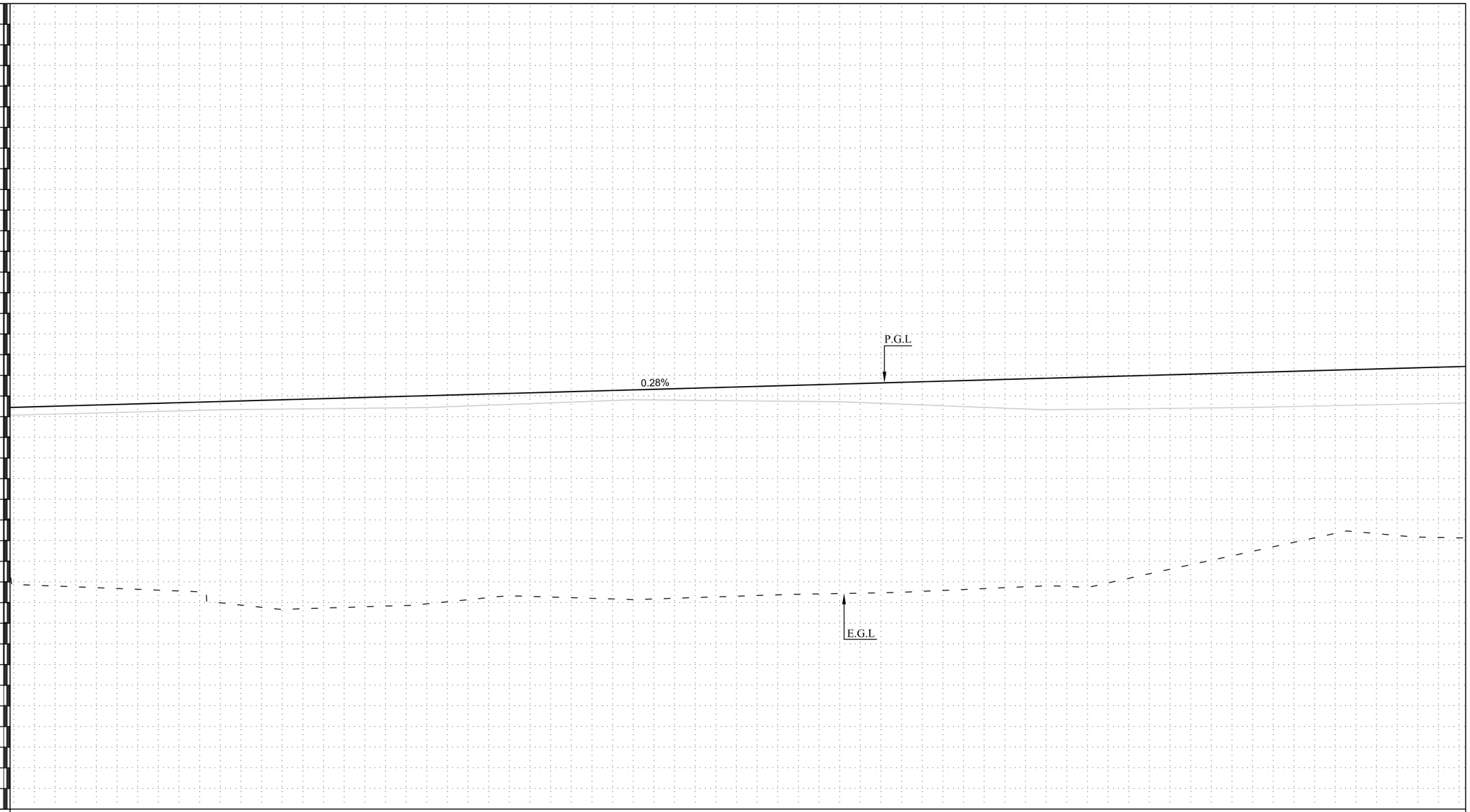
DRAWING TITLE:

PROFILE AT
KM 11+200 TO 11+900

DESIGN BY: AYESHA SHABBIR	SHEET NO: 17 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/16



H.C.D.	349.52
V.C.D.	3030.91 0.28%

CHAINAGE	L. DIFF.	E.G.L.	P.G.L.
11+900	8.573	10.877	19.449
11+920	8.708	10.798	19.506
11+940	8.844	10.718	19.562
11+960	8.979	10.639	19.618
11+980	9.115	10.560	19.675
12+000	9.744	9.987	19.731
12+020	10.019	9.768	19.787
12+040	10.145	9.698	19.844
12+060	10.138	9.762	19.900
12+080	10.130	9.826	19.956
12+100	10.079	9.934	20.013
12+120	9.931	10.138	20.069
12+140	9.798	10.328	20.125
12+160	9.916	10.265	20.182
12+180	10.035	10.203	20.238
12+200	10.154	10.140	20.294
12+220	10.145	10.206	20.351
12+240	10.134	10.273	20.407
12+260	10.123	10.340	20.463
12+280	10.119	10.401	20.520
12+300	10.140	10.436	20.576
12+320	10.162	10.471	20.632
12+340	10.148	10.541	20.689
12+360	10.115	10.630	20.745
12+380	10.081	10.720	20.801
12+400	10.048	10.809	20.858
12+420	10.178	10.735	20.914
12+440	9.797	11.173	20.970
12+460	9.414	11.612	21.026
12+480	9.036	12.046	21.083
12+500	8.658	12.481	21.139
12+520	8.280	12.915	21.195
12+540	7.902	13.350	21.252
12+560	7.972	13.336	21.308
12+580	8.194	13.170	21.364
12+600	8.290	13.131	21.421

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

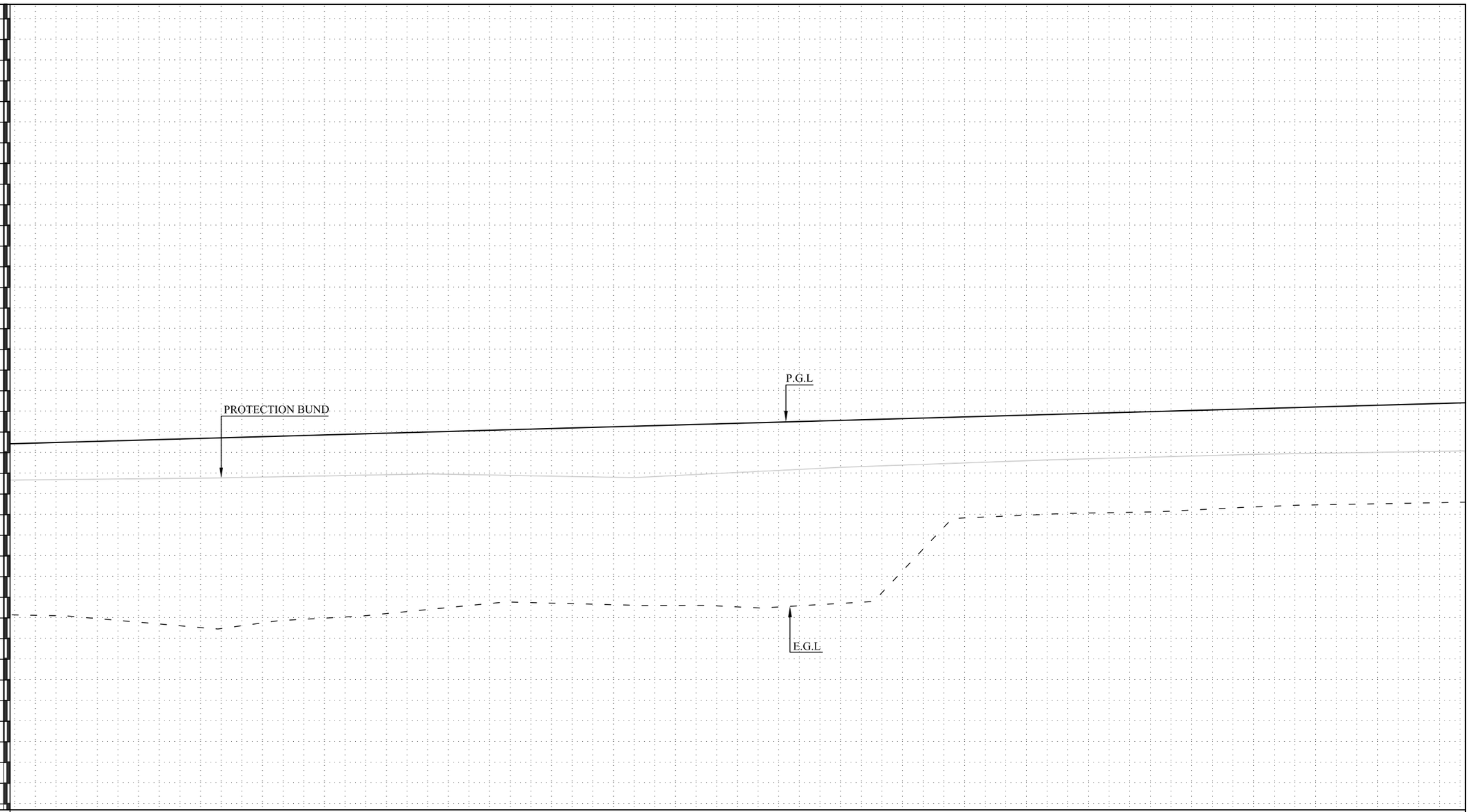
DRAWING TITLE:

PROFILE AT
KM 11+900 TO 12+600

DESIGN BY:	SHEET NO:
AYESHA SHABBIR	18 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/17



CHAINAGE	L. DIFF.	E.G.L.	P.G.L.	V.C.D.	H.C.D.
12+600	8.290	13.131	21.421		
12+620	8.386	13.091	21.477		
12+640	8.582	12.951	21.533		
12+660	8.812	12.778	21.590		
12+680	9.041	12.605	21.646		
12+700	9.234	12.468	21.702		
12+720	9.016	12.743	21.759		
12+740	8.897	12.918	21.815		
12+760	8.843	13.028	21.871		
12+780	8.736	13.192	21.928		
12+800	8.596	13.388	21.984		
12+820	8.457	13.584	22.040		
12+840	8.345	13.752	22.097		
12+860	8.453	13.700	22.153		
12+880	8.561	13.648	22.209		
12+900	8.669	13.596	22.266		
12+920	8.732	13.590	22.322		
12+940	8.813	13.566	22.378		
12+960	8.966	13.469	22.434		
12+980	8.919	13.572	22.491		
13+000	8.860	13.687	22.547		
13+020	8.396	14.208	22.603		
13+040	6.340	16.320	22.660		
13+060	4.892	17.824	22.716		
13+080	4.859	17.913	22.772		
13+100	4.827	18.002	22.829		
13+120	4.826	18.059	22.885		
13+140	4.846	18.095	22.941		
13+160	4.844	18.153	22.998		
13+180	4.796	18.258	23.054		
13+200	4.756	18.354	23.110		
13+220	4.731	18.435	23.167		
13+240	4.750	18.473	23.223		
13+260	4.771	18.508	23.279		
13+280	4.792	18.544	23.336		
13+300	4.807	18.585	23.392		

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

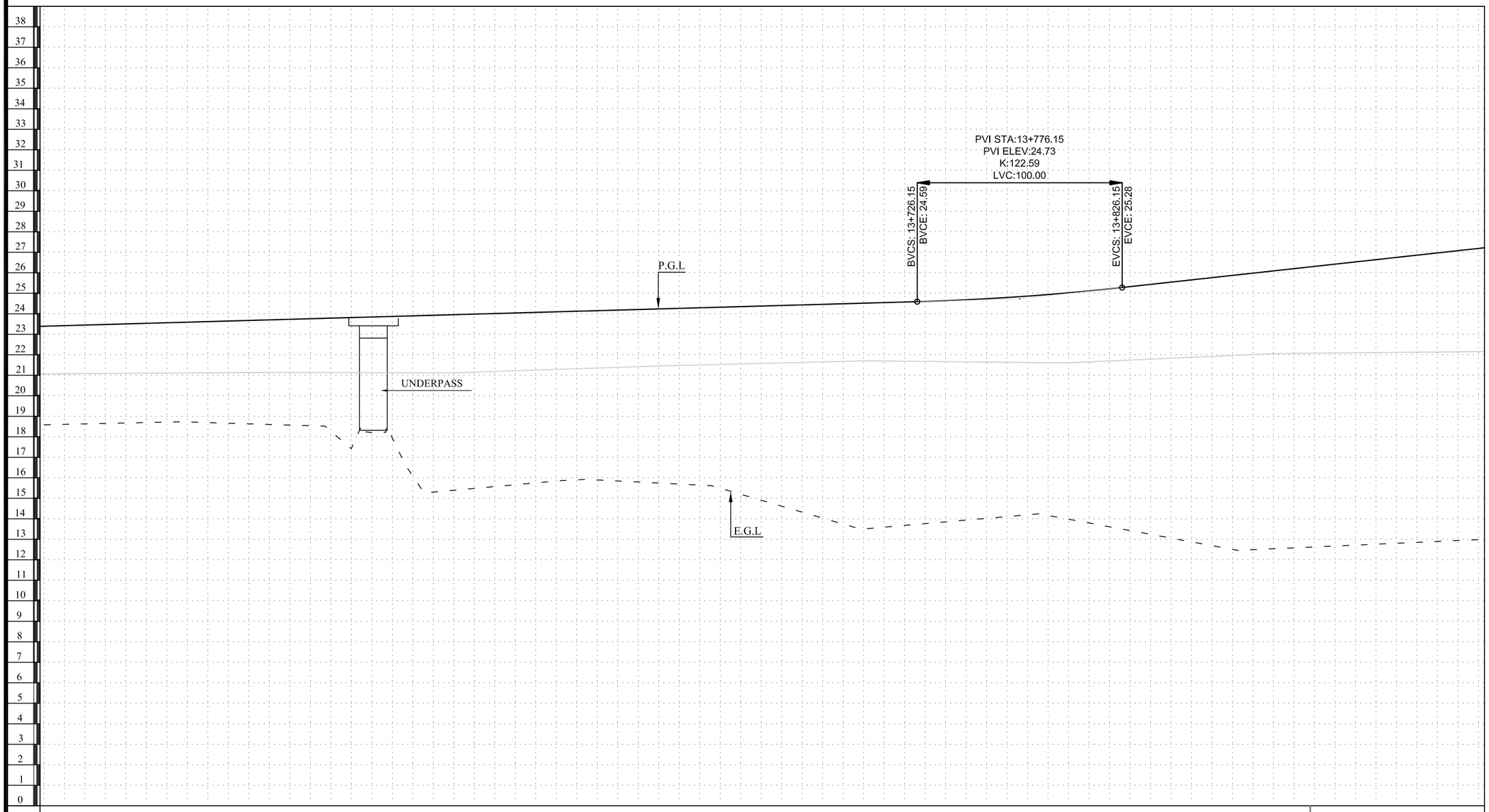
DRAWING TITLE:

PROFILE AT
KM 12+600 TO 13+300

DESIGN BY:	SHEET NO:
AYESHA SHABBIR	19 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/18



H.C.D.	L=1682.65 R=2500.00
V.C.D.	100.00 12258.87

CHAINAGE	L. DIFF.	E.G.L.	P.G.L.
13+300	4.807	18.585	23.392
13+320	4.819	18.629	23.448
13+340	4.832	18.673	23.505
13+360	4.846	18.715	23.561
13+380	4.925	18.692	23.617
13+400	5.042	18.632	23.674
13+420	5.158	18.571	23.730
13+440	5.512	18.274	23.786
13+460	5.639	18.203	23.842
13+480	7.818	16.080	23.899
13+500	8.564	15.391	23.955
13+520	8.441	15.571	24.011
13+540	8.318	15.750	24.068
13+560	8.227	15.897	24.124
13+580	8.336	15.845	24.180
13+600	8.494	15.743	24.237
13+620	8.651	15.642	24.293
13+640	9.153	15.197	24.349
13+660	9.791	14.614	24.406
13+680	10.429	14.033	24.462
13+700	11.016	13.502	24.518
13+720	10.899	13.676	24.575
13+740	10.790	13.849	24.639
13+760	10.713	14.021	24.734
13+780	10.668	14.194	24.862
13+800	11.044	13.978	25.022
13+820	11.606	13.609	25.215
13+840	12.192	13.241	25.433
13+860	12.779	12.874	25.653
13+880	13.364	12.508	25.872
13+900	13.555	12.537	26.092
13+920	13.686	12.626	26.311
13+940	13.815	12.715	26.531
13+960	13.945	12.805	26.750
13+980	14.075	12.895	26.970
14+000	14.205	12.984	27.189

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :
LOYA-ZEERUK J.V.
M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)
ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

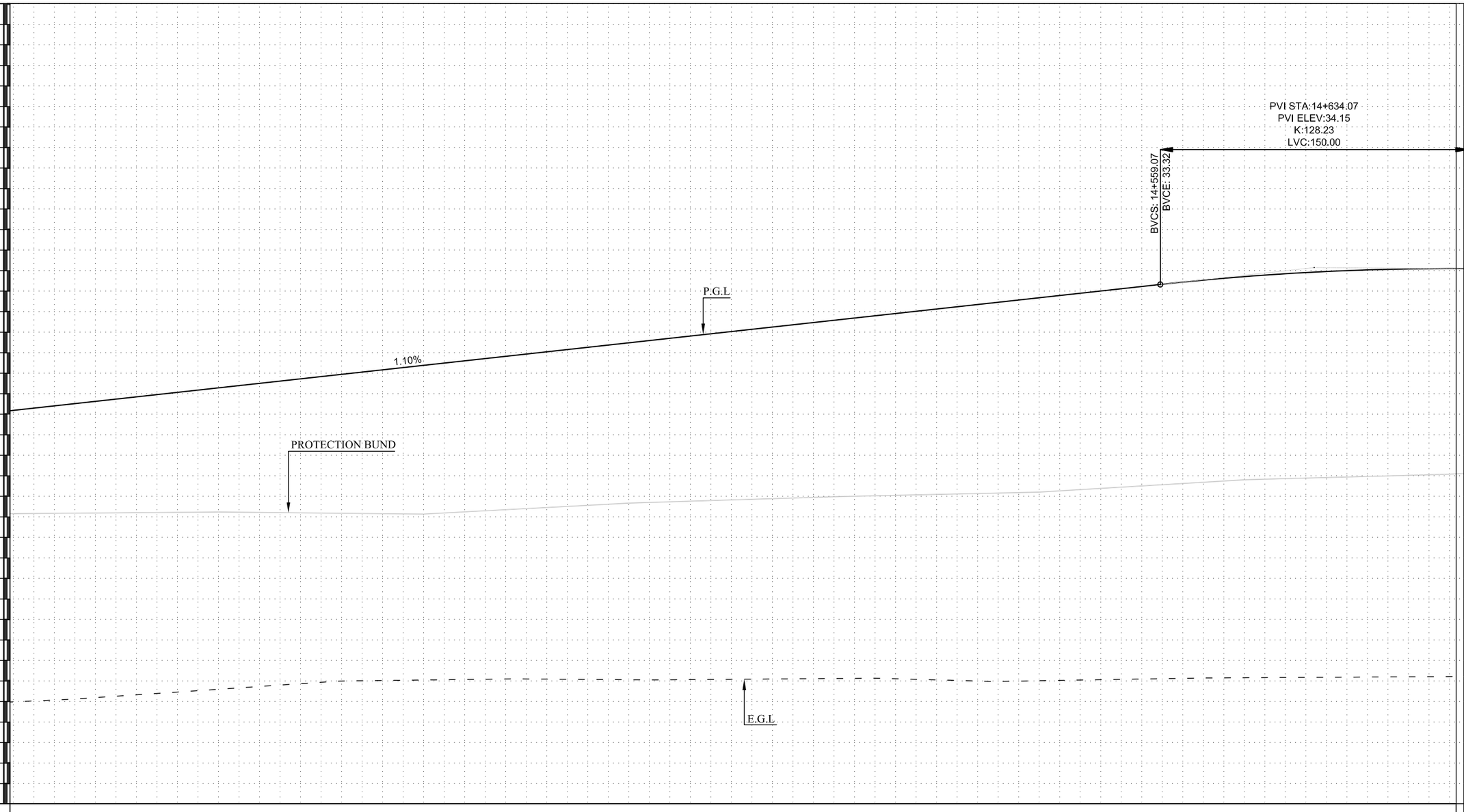
DRAWING TITLE:

PROFILE AT
KM 13+300 TO 14+000

DESIGN BY: AYESHA SHABBIR	SHEET NO: 20 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/19



CHAINAGE	L. DIFF.	E.G.L.	P.G.L.
14+000	14.205	12.984	27.189
14+020	14.336	13.073	27.409
14+040	14.436	13.192	27.628
14+060	14.521	13.326	27.848
14+080	14.606	13.461	28.067
14+100	14.690	13.597	28.286
14+120	14.773	13.733	28.506
14+140	14.856	13.869	28.725
14+160	14.945	14.000	28.945
14+180	15.140	14.024	29.164
14+200	15.336	14.048	29.384
14+220	15.531	14.072	29.603
14+240	15.726	14.097	29.823
14+260	15.951	14.091	30.042
14+280	16.186	14.076	30.262
14+300	16.421	14.060	30.481
14+320	16.642	14.059	30.701
14+340	16.846	14.074	30.920
14+360	17.050	14.090	31.140
14+380	17.254	14.105	31.359
14+400	17.457	14.121	31.579
14+420	17.661	14.137	31.798
14+440	17.936	14.081	32.017
14+460	18.211	14.026	32.237
14+480	18.476	13.980	32.456
14+500	18.663	14.013	32.676
14+520	18.849	14.046	32.895
14+540	19.036	14.079	33.115
14+560	19.222	14.112	33.334
14+580	19.392	14.145	33.537
14+600	19.548	14.159	33.708
14+620	19.677	14.171	33.848
14+640	19.775	14.182	33.957
14+660	19.841	14.193	34.034
14+680	19.876	14.205	34.081
14+700	19.880	14.216	34.096

V.C.D.: 732.96 / 1.10% ; 12822.52 / 150.00

H.C.D.

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

MALIR EXPRESSWAY (PVT) LTD

E.P.C. CONSULTANT :

LOYA-ZEERUK J.V.

M/S LOYA ASSOCIATES (DESIGN AND FINANCIAL CONSULTANT)

ZEERUK INTERNATIONAL (PVT)LTD
3rd Floor, Time Square Plaza,
I-8 Markaz, Islamabad
Ph: 051-4938213-4, FAX: 051-4938215

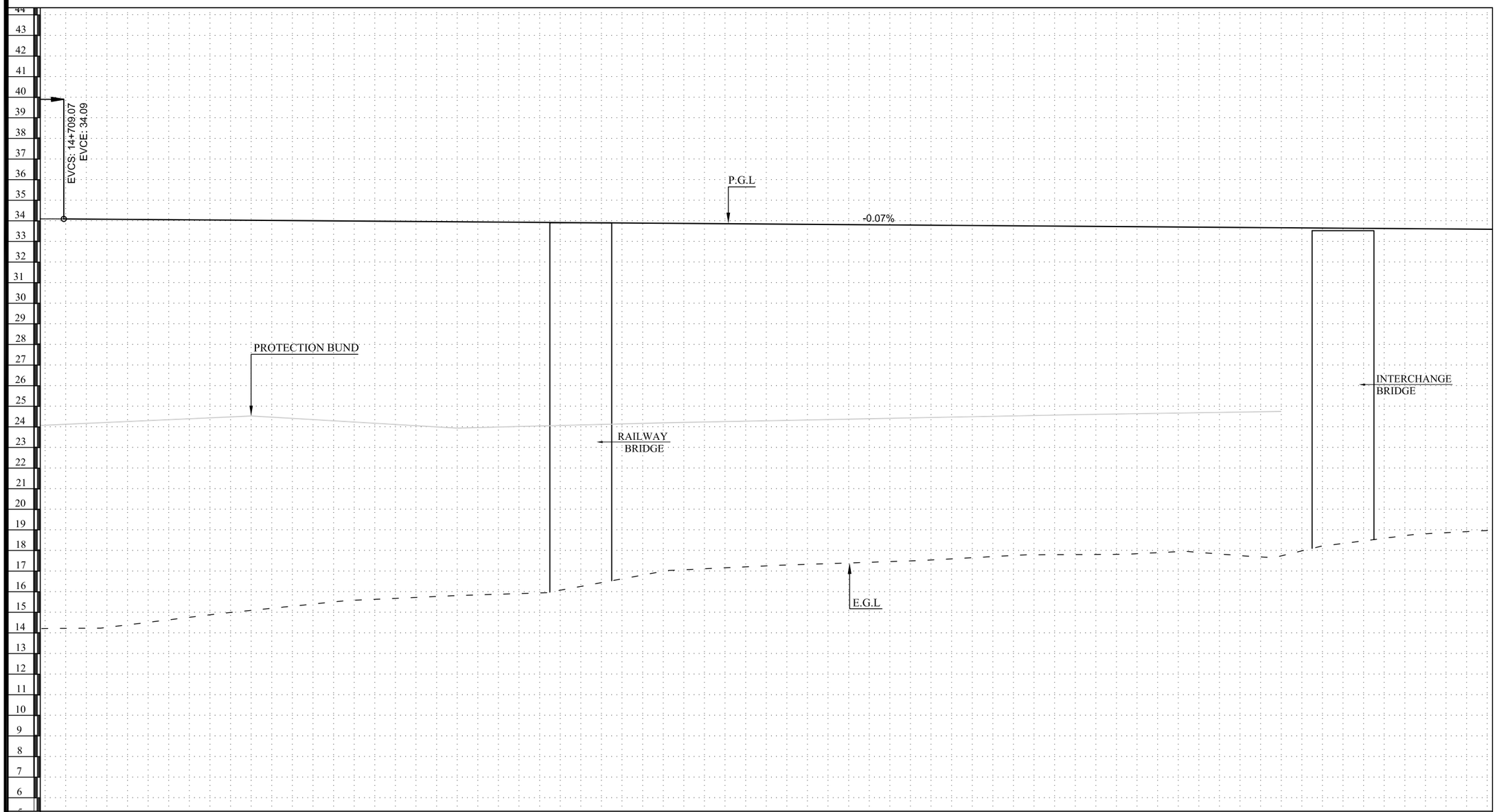
DRAWING TITLE:

PROFILE AT
KM 14+000 TO 14+700

DESIGN BY: AYESHA SHABBIR	SHEET NO: 21 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/20



H.C.D.	L=740.73
V.C.D.	790.93 -0.07%

CHAINAGE	L. DIFF.	E.G.L.	P.G.L.
14+700	19.880	14.216	34.096
14+720	19.858	14.227	34.085
14+740	19.680	14.390	34.070
14+760	19.421	14.634	34.056
14+780	19.163	14.879	34.041
14+800	18.934	15.093	34.027
14+820	18.715	15.297	34.012
14+840	18.496	15.502	33.998
14+860	18.353	15.630	33.983
14+880	18.246	15.722	33.969
14+900	18.143	15.811	33.954
14+920	18.064	15.876	33.940
14+940	17.985	15.941	33.925
14+960	17.656	16.255	33.911
14+980	17.274	16.623	33.896
15+000	16.892	16.990	33.882
15+020	16.756	17.112	33.867
15+040	16.647	17.206	33.853
15+060	16.544	17.295	33.838
15+080	16.462	17.362	33.824
15+100	16.381	17.428	33.809
15+120	16.300	17.495	33.795
15+140	16.186	17.594	33.780
15+160	16.062	17.704	33.766
15+180	15.961	17.791	33.751
15+200	15.934	17.803	33.737
15+220	15.907	17.815	33.722
15+240	15.814	17.894	33.708
15+260	15.785	17.909	33.693
15+280	15.929	17.750	33.679
15+300	15.924	17.740	33.664
15+320	15.435	18.215	33.650
15+340	15.168	18.468	33.635
15+360	14.901	18.720	33.621
15+380	14.743	18.863	33.606
15+400	14.620	18.972	33.592

NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
BVCE.	BEGINNING OF VERTICAL CURVE ELEVATION
EVCS.	END OF VERTICAL CURVE STATION
EVCE.	END OF VERTICAL CURVE ELEVATION
PVI.	POINT OF VERTICAL INTERSECTION
ELEV.	ELEVATION
LVC.	LENGTH OF VERTICAL CURVE
K	K-FACTOR (RATE OF VERTICAL CURVATURE)
L	LENGTH OF HORIZONTAL CURVE
R	RADIUS OF HORIZONTAL CURVE

REV.	REVISION/ISSUE	DATE

PROJECT:

MALIR EXPRESSWAY PROJECT

CLIENT:

LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

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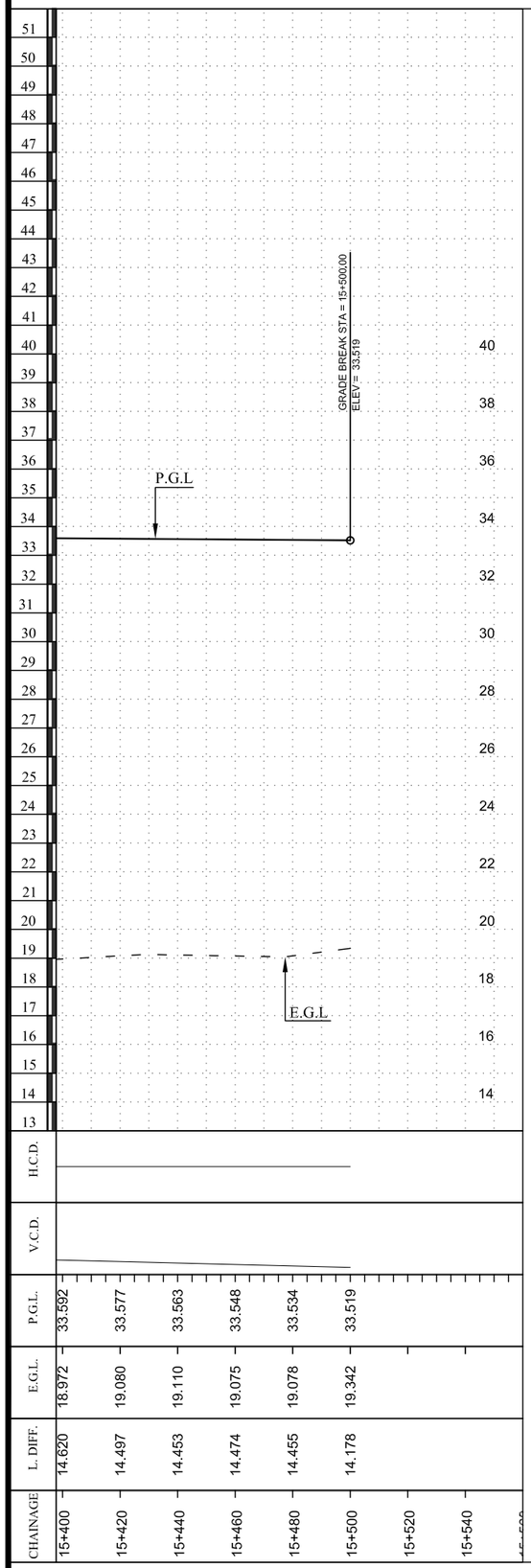
DRAWING TITLE:

PROFILE AT
KM 14+700 TO 15+400

DESIGN BY: AYESHA SHABBIR	SHEET NO: 22 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

ZI-LOYA/MALIR/PR/21



NOTES

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. FOR SETTING OUT DATA REFER. DWG NO: ZI-LOYA/MALIR/S.O/01
3. FOR LEGEND & ABBREVIATION REFER. DWG NO: ZI-LOYA/MALIR/GEN/02
4. FOR TYPICAL CROSS SECTIONS REFER DWG NO: ZI-LOYA/MALIR/GEN/04A-04F
5. FOR GEOMETRIC DESIGN CRITERIA REFER DWG NO:ZI-LOYA/MALIR/GEN/07
6. FOR EMBANKMENT PROTECTION REFER DWG NO: ZI-LOYA/MALIR/GEN/05

ABBREVIATIONS

STA.	STATION
H.C.D.	HORIZONTAL CURVE DATA
V.C.D.	VERTICAL CURVE DATA
P.G.L.	PROPOSED GRADE LEVEL
E.G.L.	EXISTING GROUND LEVEL
L. DIFF.	LEVEL DIFFRENCE
BVCS.	BEGINNING OF VERTICAL CURVE STATION
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K	K-FACTOR (RATE OF VERTICAL CURVATURE)
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REV.	REVISION/ISSUE	DATE

PROJECT:

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LOCAL GOVERNMENT DEPARTMENT
GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:

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DRAWING TITLE:

PROFILE AT
KM 15+400 TO 15+500

DESIGN BY: AYESHA SHABBIR	SHEET NO: 23 of 23
DRAWN BY: RAJA FARHAT	SCALE: H= 1:2000 V= 1:200
CHECKED BY: ZAFAR ALI	DATE: SEP, 2020
APPROVED BY: M. ANWAR	REVISION: REV. 00

CAD FILE NAME:

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Annex III – Pavement Design

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MALIR EXPRESSWAY PROJECT

UNDER DESIGN, FINANCE, BUILD, MAINTAIN, OPERATE AND TRANSFER BASIS (DFBOT)



PAVEMENT DESIGN REPORT

JANUARY, 2021

DESIGN & QUALITY CONSULTANT ASSOCIATION

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1 Introduction

Project Malir Expressway shall be an Access Controlled facility, start point of which is near Jam Sadiq Bridge which is on Right Bank of Malir River and travelling along the Malir River upto the existing Link Road between N5 and M9 (2.4 km short of M9). From this junction point, the alignment will take a left turn and following the route upto M9, where the RD is 39.3 km. The exiting portion of Link Road between N5 and M9 will need modification to meet the requirements of Expressway Typical Cross-Section. Similarly, the existing Trumpet Interchange on M9 will also be modified to meet the design requirements of the Expressway.

2 Pavement Design Methodology

Prior to giving the particulars of pavement design, a general note on pavement design methodology is given hereunder to emphasize its importance. Pavement is the top layer of the road structure, which sustains all type of wheel loads, and transfers it to the underlying embankment layers below the subgrade. Safe functioning of the subgrade is to transmit the wheel loads to the bottom sub-structure without causing any damage up to the full design life of the road. Basic principle of load transfer in pavement is to transfer loads in the form of stresses and strains from top to bottom i.e., maximum stresses are taken by the top layers that is why, the strongest layer is provided at the top with gradual strength reduction in subsequent layers.

Over the years different type of pavements have been used depending mainly on the axle loading, availability of material, drainage conditions, budget allocation and the environment of the project area. Mainly, there are two basic types of pavements: Flexible and Rigid. After the type selection for the pavement, the other major aspect in design is to decide upon the combination of various layers of materials with varied stiffness/strength parameters. Selected thicknesses of pavement layers mainly depend on the total estimated Equivalent Single Axle Loads (ESALs) spread over the design life of the project road, subgrade strength (expressed as CBR) and the environment. In the design of a pavement structure, all these factors are determined in accordance with the project field investigation and studies, available historical data and the environmental history of the project vicinity.

3 AASHTO Procedure for Flexible Pavement Design

The AASHTO Guide for Pavement Design 1993 outlines this procedure for determination of flexible pavement thickness by solving AASHTO equations manually. In all options basically the Structure Number (SN) required to be assigned to the proposed pavement structure for a given set of conditions is determined by solving the following numerical equation

$$\log_{10} W_{18} = Z_R S_O + 9.36 \times \log_{10}(SN+1) + \frac{\log_{10}\left[\frac{\Delta PSI}{(4.2-1.5)}\right]}{0.4 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 \times \log_{10} M_R - 8.07$$

The required variable data to be substituted into this equation are:

- The estimated future traffic in term of ESAL for the design period W18
- The reliability level, R
- Standard normal deviate value, ZR
- The overall standard deviation, So
- The roadbed soil resilient modulus, MR
- The design serviceability loss, ΔPSI = Po – Pt

4 Design Life of Flexible Pavement

Design life is the number of years reckoned from the completion of pavement construction and application of traffic load until the time, when major maintenance is required, so that it can continue to carry traffic satisfactorily for further period. A design period of 10 years has been adopted for the project road.

5 Directional Distribution Factor DD

According to AASHTO guide 1993 a directional distribution factor expressed as a ratio that accounts for the distribution of the ESAL units by direction, e.g. east-west, north-south, etc. etc.

DD factor is generally 0.5 (50 percent) for most roadways, there are instances where more weight may be moving in one direction than the other, Thus, the side with heavier vehicles should be designed for greater number of ESAL units, Experience has shown that DD may vary from 0.3 to 0.7 depending on which direction is “loaded” and which is “un-loaded”. DD value of 0.50 has been adopted in the calculations.

6 Lane Distribution Factor D_L

According to AASHTO guide 1993 a lane distribution factor expressed as a ratio, that accounts for distribution of traffic when two or more lanes are available in one direction.

For DL factor the following Table 1 may be used as a guide:

Table 1: Lane Distribution Factor

Number of Lanes in each direction	Percent of 18-kip ESAL in design lane
1	**100**
2	80 - 100
3	**60 - 80**
4	50 - 75

For the road three lanes in each direction, 0.8 (80 percent) factor has been adopted in the calculations.

7 Total ESALs for Design Life of Flexible Pavement

The design is based upon the cumulative expected 18-kip equivalent single axle loads (ESAL's) during the design period. Design traffic for this project is 100 million ESALs per lane as provided in Request for Proposal (RFP). For the purpose of this pavement design report EALF's from NTRC study 1995 have been adopted. Based on classified traffic counts calculation for design ESALs has been done and shown in Table 2. For detail please consult Traffic StudyReport by Zeeruk International Private Limited.

Table 2: ESALs Estimation

Years	AGR %	Buses	TRUCKS					Design ESALs
			2-Axle	3-Axle	4 -Axle	5 -Axle	6 -Axle	
		5	4	4	4	4	4	
EALF	Loaded	0.94	4.67	8.84	10.35	12.95	10.84	
	Empty		0.048	0.08	0.41	0.55	0.26	
2022	1	882	1058	1963	2415	832	1285	8,587,907
2023	2	926	1100	2042	2512	865	1336	17,520,540
2024	3	972	1144	2123	2612	900	1390	26,811,750
2025	4	1021	1190	2208	2717	936	1445	36,475,943
2025	5	1021	1190	2208	2717	936	1445	46,140,135
2026	6	1072	1238	2296	2825	973	1503	56,192,297
2027	7	1126	1287	2388	2938	1012	1563	66,648,016
2028	8	1171	1332	2472	3041	1048	1618	77,470,458
2029	9	1218	1379	2558	3147	1084	1675	88,672,489
2030	10	1266	1427	2648	3258	1122	1733	**100,267,427**

Adopted Cumulative ESALs for 10 year design life = 100 Million

8 California Bearing Ratio (CBR)

California Bearing Ratio (CBR) test has been used commonly by many design procedures as an index of shear strength of unbound materials. With this procedure the strength of the subgrade materials can be determined and expressed in terms of a CBR value. CBR values for the subgrade material can be determined in the laboratory as well as field test for CBR can be carried out.

9 Design CBR for the Project Road

The design of pavement is based on the soaked CBR value of minimum15% for subgrade compacted @ 95% of maximum dry density (MDD) AASHTO T-193.

10 Design Variables of Flexible Pavement

10.1 Reliability (R)

Design reliability refers to the degree of certainty that a given design alternative will last for the entire design period. **Table 3** provides suggested levels of reliability for various functional classifications recommended by AASHTO. The recommended level of reliability for principal arterial in urban areas varies from 80% to 99%. A design reliability level of **95%** has been adopted for pavement design of the project road.

Table 3: Recommended Level of Reliability (R)

Functional Classification	Reliability (%)	
	Urban	Rural
Interstate and Other Freeways	85-99.9	80-99.9
Principal Arterial	80-99	75-95
Collectors	80-95	75-95
Local	50-80	50-80

10.2 Standard Deviation (So)

The reliability factor is a function of the overall standard deviation that accounts for standard variation in materials and construction, the probable variation in the traffic prediction and the normal variation in pavement performance for a given design traffic application. The adopted value of standard deviation for total variation in material properties and in traffic estimation for flexible pavement is **0.45**.

10.3 Standard Normal Deviation (Z_R)

The recommended values of standard normal deviation (Z_R) by AASHTO Guide 1993 are given in **Table 4**. The value corresponding to reliability (R) of 95% is **-1.645** which has been adopted in the design of the project road.

Table 4: Standard Normal Deviate (Z_R)

Reliability (R) %	Standard Normal Deviate (Z_R)
80	-0.841

Reliability (R) %	Standard Normal Deviate (Z_R)
90	-1.282
95	**-1.645**

11 Performance Criteria of Flexible Pavement

The serviceability of a pavement is defined as its ability to serve the type of traffic that used the facility. Initial and terminal serviceability indexes have been established to compute the total change in serviceability that will be used in the design equations.

11.1 Initial Serviceability Index (P_o)

The initial serviceability index is a function of pavement design and construction quality. For flexible pavement design typical value, as recommended by AASHTO Road Test, is 4.2 which has been adopted for the project road.

11.2 Terminal Serviceability Index (P_t)

The terminal serviceability index is the lowest index that will be tolerated before rehabilitation, resurfacing or reconstruction becomes necessary and it generally varies with the importance or functional classification of the pavement. Recommended value of terminal serviceability index is 2.5 for the project road.

11.3 Resilient Modulus (M_R)

The basis for material characterization in AASHTO guide 1993 is elastic or Resilient Modulus (MR). In the absence of necessary equipment required to determine resilient modulus of subgrade, following correlation between CBR and MR has been used. The correlation has been adopted from the Transport Research Laboratory (TRL).

$\mathbf{M_R = 2555\ (CBR)^{0.64}}$ where $\mathbf{M_R}$ is resilient modulus in psi.

M_R = 14000 psi.

12 Pavement Structural Number

Once the design structural number (**SN**) for an initial pavement structure has been determined, identified set of pavement layers thickness that will provide the required load carrying capacity which corresponds to the design structural number are calculated. Under AASHTO design procedure the following equation provides the means for converting the structural number into actual thickness of surfacing, base and subbase materials:

$$SN = a_1D_1 + a_2D_2m_2 + a_3D_3m_3$$

The required variable data to be substituted into this equation are:

a1: asphalt layer coefficient
a2: aggregate base layer coefficient
a3: granular subbase layer coefficient
D1: thickness of asphalt layer
D2: thickness of aggregate base layer
D3: thickness of granular subbase layer
m2: drainage coefficient of aggregate base layer
m3: drainage coefficient of granular subbase layer

The equation does not have single unique solution. There are many combinations of layer thicknesses that can be adopted to achieve a given structural number.

12.1 Layer Coefficients

The layer coefficient is a measure of the relative ability of a unit thickness of a given material to function as a structural component of the pavement. AASHTO 1993 Guide for Design of Pavements recommended the two equations for the calculation of layer coefficients of aggregate base and subbase materials. For the layer coefficient of asphalt, a graph (Article 2.3.5, Figure 2.5) is provided in the AASHTO Guide 1993.

a) Asphalt Concrete

The value of layer coefficient for asphalt concrete depends upon the modulus value of type of asphalt material selected. Caution should be used in selecting layer coefficient with modulus values greater than 450000 psi, because the use of larger moduli is accompanied by increased susceptibility to thermal and fatigue cracking. Higher modulus asphalt concretes are stiffer and more resistant to bending. Layer coefficient value of 0.40 per inch for asphalt concrete has been selected from the AASHTO guide 1993 (Article 2.3.5, Figure 2.5) for the design of project road.

b) Base and Subbase Courses

Aggregate Base Course has CBR of 80% compacted @ 100% of MDD and corresponding E2 is 28000 psi. Granular Subbase Course has minimum CBR of 50% compacted @98% of MDD and corresponding E3 is 17000 psi. Following equations have been used to calculate the value of layer coefficients a2 and a3 of aggregate base and subbase respectively. The two equations from the AASHTO Guide 1993 for the layer coefficients of aggregate base and subbase materials are:

Aggregate Base Course $a_2 = 0.249 \times \log_{10} E_2 - 0.977$

Granular Subbase Course $a_3 = 0.227 \times \log_{10} E_3 - 0.839$

a_2 = 0.13/inch **a_3 = 0.12/inch**

12.2 Drainage Coefficient (m_i)

AASHTO Guide for Design of Pavement Structures 1993 describes various levels of drainage quality for flexible pavement design as shown in Table 5.

Table 5: Quality of Drainage

Quality of Drainage	Water Removed Within
Excellent	2 hours
Good	**1 day**
Fair	1 week
Poor	1 month
Very Poor	Water will not drain

The layer coefficients of untreated layers have to be modified by using a suitable drainage factor as recommended by AASHTO. These as referred to "mi" value are the function of quality of drainage and the percent of time during the year the pavement structure would be exposed to moisture levels approaching saturation.

The pavement structure has been designed by assuming that it will be exposed to moisture level approaching saturation greater than twenty-five percent. As the pavement will be constructed on embankment and keeping in view the project environment the recommended value to mi = 1 has been adopted for good quality of drainage as shown in Table 6.

Table 6: Recommended m_i Values for Modifying Structural Layer Coefficients of Untreated Base and Subbase Materials in Flexible Pavements

Quality of Drainage	Percent of Time Pavement Structure is Exposed to Moisture Levels Approaching Saturation			
	Less Than		Greater Than	
	1%	1-5%	2-25%	25%
Excellent	1.40 – 1.35	1.35 – 1.30	1.30 – 1.20	1.20
Good	1.35 – 1.25	1.25 – 1.15	1.15 – 1.00	**1.00**
Fair	1.25 – 1.15	1.15 – 1.05	1.00 – 0.80	0.85
Poor	1.15 – 1.05	1.05 – 0.80	0.80 – 0.60	0.60
Very Poor	1.05 – 0.95	0.95 – 0.75	0.75 – 0.40	0.40

13 Proposed Flexible Pavement Design for the Carriageway

Thickness of asphalt concrete, aggregate base course and granular subbase are calculated using following data.

The required structural number (SN_{req}) of the new pavement is determined by using the following equation by AASHTO Pavement Design Guide 1993:

$$\log_{10} W_{18} = Z_R S_0 + 9.36 \times \log_{10}(SN_{req} + 1) + \frac{\log_{10}\left[\frac{\Delta PSI}{(4.2-1.5)}\right]}{0.4 + \frac{1094}{(SN_{req}+1)^{5.19}}} + 2.32 \times \log_{10} M_R - 8.07$$

Where
W18 = 100 x 106 ESALs
ZR = -1.645 (R = 95%)

$$S_0 = 0.45$$

Δ PSI = $P_\circ$-P_t = 4.2 – 2.5 = 1.7
MR = 14000 psi (CBR $\geq$ 15%)
Therefore, SN_{Req} = 5.877

The provided structural number (SN_{Pro}) of the pavement is determined by using the equation:

$$SN_{pro} = a_1 D_1 + a_2 D_2 m_2 + a_3 D_3 m_3$$

Where

D1 = 21 cm	a1 = 0.157 per cm	
D2 = 30 cm	a2 = 0.051 per cm	m2 = 1
D3 = 25 cm	a3 = 0.047 per cm	m3 = 1

Therefore, SN_{PRO} = 6.002

Since, $SN_{Pro} \geq SN_{Req}$, the provided thicknesses are adequate.

It is proposed to use the following pavement layer thicknesses for the carriageway that can tolerate design traffic of 100 million ESALs. Thicknesses are shown in Table: 7.

Table:7 Proposed Pavement Thicknesses for Carriageway

Layer	Proposed Thicknesses (cm)
Asphalt Wearing Course	5
Asphalt Base Course	16
Aggregate Base Course	30
Granular Sub-base Course	25
Subgrade (CBR ≥ 15%)	30

14 Inner Shoulder Design

It is recommended to use the inner shoulder having the same structure as that of the main carriageway.

15 Outer Shoulder Design

For the main carriageway three meter wide outer shoulder has been proposed. It is recommended to use the outer shoulder design given in Table: 8 for the carriageway. For outer shoulders 5 cm wearing course shall be monolithic with the carriageway, 15 cm thick aggregate base course layer shall be provided below the top layer and the remaining gap between the provided aggregate base layer and the subgrade top shall be filled with subbase material keeping in view the day-lighting concept of the pavement layers.

Table: 8 Outer Shoulder Thicknesses

Layer	Proposed Thicknesses (cm)
Asphalt Wearing Course	5
Aggregate Base Course	15
Subbase	56

16 Pavement Design Validation by Mechanistic Approach

While the AASHTO analysis does provide an accurate appraisal of overall pavement adequacy, the major weakness of the AASHTO analysis occurs with its inability to address (or even evaluate) the fatigue fracture distress in the asphalt layer.

The philosophy underlying the mechanistic approach is that the design of the flexible pavement structure should be handled in the same way as other civil engineering structures: (i) specify the loading; (ii) estimate the size of components; (iii) consider the materials available; (iv) carry out structural analysis using theoretical principles; (v) compare stresses, strains or deflections

with allowable values; (vi) make adjustments to materials or geometry until a satisfactory design is achieved; and (vii) evaluate economic feasibility of the result. If this approach is adopted, the design task in relation to a flexible pavement becomes one of the proportioning the structures so that the critical levels of stress or strain are not exceeded during the pavement's design life. This, in turn, requires the knowledge of the engineering properties of the pavement materials, including (a) effective stiffness modulus, which governs load-spreading behavior, (b) deformation resistance which covers rutting behavior, and (c) fatigue resistance, which, relates to cracking behavior.

Results from the mechanistic analysis, together with other parameters, are used as input to two performance models derived on the basis of field data, to predict the fatigue life and rut depth. These performance models are currently restricted to three-layer pavements with asphalt concrete (AC) surface, base and roadbed soil, and four-layer pavements with AC surface, base, subbase and roadbed soil. Fatigue life and rut depth estimates for other types of sections may be meaningless. The models relate the fatigue life and rut depth to the number of equivalent 18-kip single-axle loads, surface deflection, moduli and thicknesses of the layers, percent air voids in the asphalt, tensile strain at the bottom of the asphalt layer, average compressive strain in the asphalt layer, kinematic viscosity of the asphalt binder, and average annual air temperature.

MICHPAVE is a user-friendly, non-linear finite element program for the analysis of flexible pavements. The program computes displacements, stresses and strains within the pavement due to a single circular wheel load. Useful design information such as fatigue life and rut depth is estimated through empirical equations. The following pavement structure in **Table 9** was analysed using MICHPAVE software.

Table: 9Pavement Thicknesses for Carriageway

Layer	Thickness (cm)
Asphalt Wearing Course	5
Asphalt Base Course	16
Aggregate Base Course	30
Granular subbase	25
Subgrade CBR ≥ 15%	30

The results obtained from the MICHPAVE are given below:

Fatigue life of asphalt pavement = 106 x 106 ESALs. Therefore, proposed pavement structure is adequate.

For reference the output file of the michpave analysis is attached as **Annexure – A** of this report.

17 Design of Flexible Pavement Overlays

Fresh traffic count survey and visual condition survey of the pavement shall be done after end of first design life. FWD testing may be recommended to evaluate the pavement structural strength. Pavement overlay thickness may be proposed based on traffic count survey, visual condition survey and FWD testing of the pavement at that stage. Similar procedure may be adopted after end of the second design life.

Overlay thicknesses for first overlay after 11 years and second overlay after 21 years are calculated as follows. Both overlays have design life of ten years each.

17.1 First Overlay

The calculation of first overlay cannot be carried out due to the absence of classified vehicles count data in the Traffic Study Report of Malir Expressway April, 2018 by EA Consulting (Pvt) Ltd.

Design Traffic for first overlay based on traffic study carried out M/s Zeeruk International Private Limited is shown in **Table 10.**

Table 10: ESAL's Estimation for First Overlay

Years	AGR %	BUSES	TRUCKS					Design ESALs
			2-Axle	3-Axle	4 -Axle	5 -Axle	6 -Axle	
		5	4	4	4	4	4	
EALF	Loaded	0.94	4.67	8.84	10.35	12.95	10.84	
	Empty		0.048	0.08	0.41	0.55	0.26	
2022	1	882	1058	1963	2415	832	1285	
2023	2	926	1100	2042	2512	865	1336	
2024	3	972	1144	2123	2612	900	1390	
2025	4	1021	1190	2208	2717	936	1445	
2025	5	1021	1190	2208	2717	936	1445	
2026	6	1072	1238	2296	2825	973	1503	
2027	7	1126	1287	2388	2938	1012	1563	
2028	8	1171	1332	2472	3041	1048	1618	
2029	9	1218	1379	2558	3147	1084	1675	
2030	10	1266	1427	2648	3258	1122	1733	
2031	11	1317	1477	2741	3372	1162	1794	12,001,629
2032	12	1370	1529	2837	3490	1202	1857	24,424,219
2033	13	1424	1582	2936	3612	1244	1922	37,282,539
2034	14	1481	1638	3039	3738	1288	1989	50,591,878
2035	15	1541	1695	3145	3869	1333	2059	64,368,060

Years	AGR %	BUSES	TRUCKS					Design ESALs
			2-Axle	3-Axle	4 -Axle	5 -Axle	6 -Axle	
		5	4	4	4	4	4	
EALF	Loaded	0.94	4.67	8.84	10.35	12.95	10.84	
	Empty		0.048	0.08	0.41	0.55	0.26	
2036	16	1602	1754	3255	4004	1380	2131	78,627,466
2037	17	1666	1816	3369	4145	1428	2205	93,387,050
2038	18	1733	1879	3487	4290	1478	2283	108,664,363
2039	19	1802	1945	3609	4440	1530	2362	124,477,571
2040	20	1874	2013	3735	4595	1583	2445	**140,845,478**

By putting the estimated future traffic and M_R value in pavement design equation from AASHTO Pavement design guide 1993 we get the required future structural number. SN_f.
SN_f = 6.15 [design traffic of 141 x 106, M_R= 14000]

SN_R= Remaining Structural number of existing pavement at the end of Design Life = 0.85x5.877=4.995. SN_R value is based on the assumption that SN reduces by 15% of its initial value of 5.877 corresponding to 100 x 10 6design traffic and M_R= 14000 .

Asphalt Overlay Thickness = (SN_f- SN_R)/a1= (6.15-4.995)/0.157= 7.35 cm= 7 cm (say).

17.2 Second Overlay

The calculation of second overlay cannot be carried out due to the absence of classified vehicles count data in the Traffic Study Report of Malir Expressway April, 2018 by EA Consulting (Pvt) Ltd.

Design Traffic for second overlay based on traffic study carried out M/s Zeeruk International Private Limited is shown in **Table 11.**

Table 11: ESAL's Estimation for Second Overlay

Years	AGR %	BUSES	TRUCKS					Design ESALs
			2-Axle	3-Axle	4 -Axle	5 -Axle	6 -Axle	
		5	4	4	4	4	4	
EALF	Loaded	0.94	4.67	8.84	10.35	12.95	10.84	
	Empty		0.048	0.08	0.41	0.55	0.26	
2022	1	882	1058	1963	2415	832	1285	
2023	2	926	1100	2042	2512	865	1336	
2024	3	972	1144	2123	2612	900	1390	
2025	4	1021	1190	2208	2717	936	1445	

Years	AGR %	BUSES	TRUCKS					Design ESALs
			2-Axle	3-Axle	4 -Axle	5 -Axle	6 -Axle	
		5	4	4	4	4	4	
EALF	Loaded	0.94	4.67	8.84	10.35	12.95	10.84	
	Empty		0.048	0.08	0.41	0.55	0.26	
2025	5	1021	1190	2208	2717	936	1445	
2026	6	1072	1238	2296	2825	973	1503	
2027	7	1126	1287	2388	2938	1012	1563	
2028	8	1171	1332	2472	3041	1048	1618	
2029	9	1218	1379	2558	3147	1084	1675	
2030	10	1266	1427	2648	3258	1122	1733	
2031	11	1317	1477	2741	3372	1162	1794	
2032	12	1370	1529	2837	3490	1202	1857	
2033	13	1424	1582	2936	3612	1244	1922	
2034	14	1481	1638	3039	3738	1288	1989	
2035	15	1541	1695	3145	3869	1333	2059	
2036	16	1602	1754	3255	4004	1380	2131	
2037	17	1666	1816	3369	4145	1428	2205	
2038	18	1733	1879	3487	4290	1478	2283	
2039	19	1802	1945	3609	4440	1530	2362	
2040	20	1874	2013	3735	4595	1583	2445	
2041	21	1949	2084	3866	4756	1639	2531	16,942,070
2042	22	2027	2157	4001	4923	1696	2619	34,478,450
2043	23	2129	2232	4141	5095	1755	2711	52,632,777
2044	24	2235	2310	4286	5273	1817	2806	71,426,888
2045	25	2347	2391	4436	5458	1880	2904	90,883,393
2046	26	2464	2475	4591	5649	1946	3006	111,025,707
2047	27	2587	2561	4752	5846	2014	3111	131,878,075
2048	28	2717	2651	4919	6051	2085	3220	153,465,603
2049	29	2853	2744	5091	6263	2158	3332	175,814,286
2050	30	2995	2840	5269	6482	2233	3449	**198,951,046**

By putting the estimated future traffic and M_R value in pavement design equation from AASHTO Pavement design guide 1993 we get the required future structural number SN_f.
SN_f = 6.433 [design traffic of 199 x 106, M_R= 14000]

SN_R = Remaining Structural number of existing pavement = 0.8x 5.877 = 4.7016. SN_R value is based on the assumption that SN reduces by 20% of its initial value of 5.877 corresponding to 100 x 10^6 design traffic and M_R= 14000 .

Asphalt Overlay Thickness = (SN_f - SN_R)/a1 = (6.433-4.7016)/0.157= 11.02 cm= 11 cm(say).

ANNEXURE-A

MECHANISTIC ANALYSIS

TITLE

Malir Expressway

FILENAMES

Data file used for this run: mew15.dat

Name of this output file : mew15.out

INITIAL DATA

Number of layers = 4

Wheel load = 9000.0 lb.

Tire pressure = 120.00 psi.

Radius of loaded area (a) = 4.886 inches

FATIGUE LIFE & RUT DEPTH DATA

Average annual temperature = 88.00 (Fahrenheit)

Percent air voids in asphalt mix = 4.50

Kinematic viscosity = 270.00 centistoke

LAYER TYPE

1 asphalt; 2 granular; 3 cohesive

Layer number (from top)	Type (1,2,or3)
1	1
2	1
3	1
4	1

MATERIAL PROPERTIES

ASPHALT MATERIAL PROPERTIES

Layer	Name	Thickness of Layer (inches)	Modulus (psi)	Poisson's ratio	Density (lb/cu.ft)	Ko
1	AC	8.3	350000.0	.35	150.0	.70
2	Agg	11.8	28000.0	.40	120.0	.60
3	G. Sub	9.8	17000.0	.40	120.0	.70
4	Sg	12.0	14000.0	.45	120.0	1.00

Layer 4 actually semi-infinite, but thickness controls depth to which displacements/stresses are computed.

CROSS SECTIONS FOR CALCULATION OF RESULTS

Number of horizontal sections = 2 Number of vertical sections = 1

Depth for horizontal sections (inches) = 8.30 29.90

Radial distance for vertical sections (inches) = .00

DIVISION OF FINITE ELEMENT MESH

Number of elements in vertical direction

Layer	Thickness	Number of elements
1. AC	8.3	4
2. Agg	11.8	4

3. G. Sub 9.8 4

4. Sg 12.0 4

Number of elements in horizontal direction

Range (a: contact radius) Number of elements

1. R = 0 - a 4
2. R = a - 3a 4
3. R = 3a - 6a 3
4. R = 6a - 10a 2

FINAL DISPLACEMENTS, STRESSES AND STRAINS

Horizontal section 1 at depth of 8.30 inches

Displacements		**Stresses**			**Strains**			
R. dist.	R. disp.	Vert. disp.	R. strs.	Tang. strs.	Vert. strs.	Shear strs.	R. stns.	Tang. stns.	Vert. stns. Shear stns.
.6	.1096E-03	-.1223E-01	1.93	1.933	-9.627	.641	.1795E-03	.1795E-03	-.3877E-03 .6406E-04
1.8	.3194E-03	-.1212E-01	1.39	1.599	-9.563	1.514	.1641E-03	.1743E-03	-.3730E-03 .1514E-03
3.1	.5065E-03	-.1193E-01	.75	1.224	-9.264	2.320	.1422E-03	.1658E-03	-.3477E-03 .2320E-03
4.3	.6631E-03	-.1167E-01	-.03	.785	-8.829	2.911	.1143E-03	.1551E-03	-.3148E-03 .2911E-03
6.1	.8142E-03	-.1117E-01	-1.52	-.185	-8.237	3.475	.6649E-04	.1333E-03	-.2585E-03 .3475E-03
8.6	.9197E-03	-.1044E-01	-2.52	-.763	-6.885	3.534	.1989E-04	.1076E-03	-.1877E-03 .3534E-03

11.0 .9325E-03 -.9719E-02 -2.93 -1.045 -5.585 3.244 -.9362E-05 .8483E-04 -.1314E-03 .3244E-03

13.4 .8906E-03 -.9041E-02 -2.99 -1.162 -4.523 2.840 -.2493E-04 .6629E-04 -.9095E-04 .2840E-03

17.1 .7877E-03 -.8166E-02 -2.61 -1.099 -3.322 2.289 -.2967E-04 .4606E-04 -.5429E-04 .2289E-03

22.0 .6353E-03 -.7178E-02 -2.23 -1.001 -2.256 1.703 -.3272E-04 .2889E-04 -.2304E-04 .1703E-03

26.9 .4769E-03 -.6411E-02 -2.02 -1.027 -1.750 1.207 -.3211E-04 .1775E-04 -.7586E-05 .1207E-03

34.2 .2905E-03 -.5684E-02 -1.47 -.859 -1.235 .695 -.2211E-04 .8493E-05 .5072E-06 .6954E-04

44.0 .9122E-04 -.5164E-02 -1.36 -.941 -1.106 .220 -.1867E-04 .2074E-05 .4636E-05 .2196E-04

Horizontal section 2 at depth of 29.90 inches

Displacements **Stresses** **Strains**

R. dist. R. disp. Vert. disp. R. strs. Tang. strs. Vert. strs. Shear strs. R. stns. Tang. stns. Vert. stns. Shear stns.

.6 .2642E-04 -.7570E-02 -1.89 -1.888 -4.559 .040 .4325E-04 .4325E-04 -.1219E-03 .6556E-05

1.8 .7883E-04 -.7560E-02 -1.90 -1.891 -4.549 .097 .4257E-04 .4303E-04 -.1210E-03 .1601E-04

3.1 .1301E-03 -.7539E-02 -1.91 -1.894 -4.526 .158 .4144E-04 .4262E-04 -.1193E-03 .2598E-04

4.3 .1797E-03 -.7510E-02 -1.93 -1.899 -4.496 .218 .3975E-04 .4204E-04 -.1170E-03 .3592E-04

6.1 .2480E-03 -.7445E-02 -1.97 -1.916 -4.433 .302 .3600E-04 .4060E-04 -.1118E-03 .4970E-04

8.6 .3287E-03 -.7334E-02 -2.03 -1.925 -4.309 .398 .3012E-04 .3845E-04 -.1031E-03 .6549E-04

11.0 .3938E-03 -.7195E-02 -2.09 -1.936 -4.162 .474 .2316E-04 .3582E-04 -.9262E-04 .7802E-04

13.4 .4411E-03 -.7032E-02 -2.17 -1.960 -4.014 .533 .1556E-04 .3283E-04 -.8150E-04 .8780E-04

17.1 .4696E-03 -.6757E-02 -2.31 -2.022 -3.802 .575 .3878E-05 .2746E-04 -.6432E-04 .9469E-04

22.0 .4560E-03 -.6374E-02 -2.44 -2.077 -3.519 .582 -.9474E-05 .2074E-04 -.4314E-04 .9578E-04

26.9 .3871E-03 -.5993E-02 -2.56 -2.155 -3.332 .554 -.1871E-04 .1441E-04 -.2764E-04 .9124E-04

34.2 .2342E-03 -.5517E-02 -2.61 -2.256 -3.215 .432 -.2195E-04 .6847E-05 -.1723E-04 .7116E-04

44.0 .6348E-04 -.5045E-02 -2.53 -2.358 -3.312 .254 -.1299E-04 .1444E-05 -.2226E-04 .4180E-04

Vertical section 1 at radial distance of .00 inches

Displacements **Stresses** **Strains**

Depth R. disp. Vert. disp. R. strs. Tang. strs. Vert. strs. Shear strs. R. stns. Tang. stns. Vert. stns. Shear stn.

.0 .0000E+00 -.1361E-01 -167.66 -167.66 -120.00 .00 -.1783E-03 -.1783E-03 .1211E-04 .0000E+00

-1.0 .0000E+00 -.1350E-01 -112.06 -112.06 -112.91 .00 -.9516E-04 -.9516E-04 -.9837E-04 .0000E+00

-3.1 .0000E+00 -.1321E-01 -36.10 -36.10 -89.18 .00 .2221E-04 .2221E-04 -.1822E-03 .0000E+00

-5.2 .0000E+00 -.1284E-01 13.52 13.52 -52.49 .00 .7773E-04 .7773E-04 -.1764E-03 .0000E+00

-7.3 .0000E+00 -.1246E-01 61.63 61.63 -24.59 .00 .1392E-03 .1392E-03 -.1926E-03 .0000E+00

-8.3 .0000E+00 -.1226E-01 92.86 92.86 -17.28 .00 .1795E-03 .1795E-03 -.2439E-03 .0000E+00

-8.3 .0000E+00 -.1226E-01 -.94 -.94 -17.28 .00 .1795E-03 .1795E-03 -.4675E-03 .0000E+00

-9.8 .0000E+00 -.1168E-01 -.73 -.73 -11.99 .00 .1546E-03 .1546E-03 -.3923E-03 .0000E+00

-12.7	.0000E+00	-.1068E-01	-.46	-.46	-8.82	.00	.1147E-03	.1147E-03	-.2827E-03	.0000E+00
-15.7	.0000E+00	-.9947E-02	-.24	-.24	-6.90	.00	.9182E-04	.9182E-04	-.2170E-03	.0000E+00
-18.6	.0000E+00	-.9358E-02	.14	.14	-5.74	.00	.8291E-04	.8291E-04	-.1823E-03	.0000E+00
-20.1	.0000E+00	-.9090E-02	.44	.44	-5.35	.00	.8177E-04	.8177E-04	-.1726E-03	.0000E+00
-20.1	.0000E+00	-.9090E-02	-1.27	-1.27	-5.35	.00	.8177E-04	.8177E-04	-.2137E-03	.0000E+00
-21.3	.0000E+00	-.8851E-02	-1.35	-1.35	-5.10	.00	.7427E-04	.7427E-04	-.1946E-03	.0000E+00
-23.8	.0000E+00	-.8413E-02	-1.49	-1.49	-4.75	.00	.6124E-04	.6124E-04	-.1629E-03	.0000E+00
-26.2	.0000E+00	-.8043E-02	-1.61	-1.61	-4.52	.00	.5181E-04	.5181E-04	-.1391E-03	.0000E+00
-28.7	.0000E+00	-.7723E-02	-1.69	-1.69	-4.37	.00	.4559E-04	.4559E-04	-.1221E-03	.0000E+00
-29.9	.0000E+00	-.7574E-02	-1.72	-1.72	-4.33	.00	.4325E-04	.4325E-04	-.1158E-03	.0000E+00
-29.9	.0000E+00	-.7574E-02	-2.88	-2.88	-4.33	.00	.4325E-04	.4325E-04	-.1117E-03	.0000E+00
-31.4	.0000E+00	-.7422E-02	-2.94	-2.94	-4.30	.00	.3905E-04	.3905E-04	-.1010E-03	.0000E+00
-34.4	.0000E+00	-.7144E-02	-3.16	-3.16	-4.28	.00	.3159E-04	.3159E-04	-.8455E-04	.0000E+00
-37.4	.0000E+00	-.6909E-02	-3.36	-3.36	-4.30	.00	.2584E-04	.2584E-04	-.7173E-04	.0000E+00
-40.4	.0000E+00	-.6713E-02	-3.43	-3.43	-4.22	.00	.2164E-04	.2164E-04	-.5924E-04	.0000E+00
-41.9	.0000E+00	-.6624E-02	-3.47	-3.47	-4.17	.00	.1993E-04	.1993E-04	-.5300E-04	.0000E+00

TECHNICAL INFORMATION

Total number of elements = 208 Total number of nodes = 238

Number of equations = 442

Bandwidth = 30

Number of iterations to reach convergence = 1

Elastic modulus of spring along bottom boundary = 14000.0 psi Poisson's ratio of spring = .45

Relative error of convergence = 00000E+00

EQUIVALENT RESILIENT MODULUS FOR EACH LAYER

Layer	Name	Modulus (Psi.)
1	AC	350000.
2	Agg	28000.
3	G. Sub	17000.
4	Sg	14000.

TABLE OF ELEMENTS ABOUT FINITE ELEMENT MESH

1 2 3 4 5 6 7 8 9 10 11 12 13

14 15 16 17 18 19 20 21 22 23 24 25 26

27 28 29 30 31 32 33 34 35 36 37 38 39

40 41 42 43 44 45 46 47 48 49 50 51 52

53 54 55 56 57 58 59 60 61 62 63 64 65
66 67 68 69 70 71 72 73 74 75 76 77 78

79 80 81 82 83 84 85 86 87 88 89 90 91

92 93 94 95 96 97 98 99 100 101 102 103 104

105 106 107 108 109 110 111 112 113 114 115 116 117

118 119 120 121 122 123 124 125 126 127 128 129 130

131 132 133 134 135 136 137 138 139 140 141 142 143

144 145 146 147 148 149 150 151 152 153 154 155 156

157 158 159 160 161 162 163 164 165 166 167 168 169

170 171 172 173 174 175 176 177 178 179 180 181 182

183 184 185 186 187 188 189 190 191 192 193 194 195

196 197 198 199 200 201 202 203 204 205 206 207 208

TABLE OF FINAL RESILIENT MODULI

.350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06

.350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06 .350E+06

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.350E+06 .350E+06 .350E+06 .350E+06 .350E+06

.280E+05 .280E+05 .280E+05 .280E+05 .280E+05 .280E+05 .280E+05 .280E+05
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.280E+05 .280E+05 .280E+05 .280E+05 .280E+05 .280E+05 .280E+05 .280E+05
.280E+05 .280E+05 .280E+05 .280E+05 .280E+05

.170E+05 .170E+05 .170E+05 .170E+05 .170E+05 .170E+05 .170E+05 .170E+05
.170E+05 .170E+05 .170E+05 .170E+05 .170E+05

.170E+05 .170E+05 .170E+05 .170E+05 .170E+05 .170E+05 .170E+05 .170E+05
.170E+05 .170E+05 .170E+05 .170E+05 .170E+05

.170E+05 .170E+05 .170E+05 .170E+05 .170E+05 .170E+05 .170E+05 .170E+05
.170E+05 .170E+05 .170E+05 .170E+05 .170E+05

.170E+05 .170E+05 .170E+05 .170E+05 .170E+05 .170E+05 .170E+05 .170E+05
.170E+05 .170E+05 .170E+05 .170E+05 .170E+05

.140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05
.140E+05 .140E+05 .140E+05 .140E+05 .140E+05

.140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05
.140E+05 .140E+05 .140E+05 .140E+05 .140E+05

.140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05
.140E+05 .140E+05 .140E+05 .140E+05 .140E+05

.140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05 .140E+05

TABLE OF FAILURE ELEMENTS DUE TO MOHR-COULOMB FAILURE AND TENSILE FAILURE

(0 : no failure ; 1 : failure)

0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0 0 0 0

0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0

FATIGUE LIFE & RUT DEPTH DATA

Average annual temperature = 88.00 (Fahrenheit)

Percent air voids in asphalt mix = 4.50

Kinematic viscosity = 270.00 centistoke

DESIGN SUMMARY

Maximum tensile (radial) strain in the asphalt layer = 1.795E-04

Average compressive (vertical) strain in the asphalt layer = 1.602E-04

Maximum compressive (vertical) strain at top of subgrade = 1.117E-04

Fatigue life of asphalt pavement = 1.061E+08 ESAL applications.

Total expected rut depth of the pavement = 3.02614E-01 inches

Expected rut depth in the asphalt course = 2.05321E-01 inches

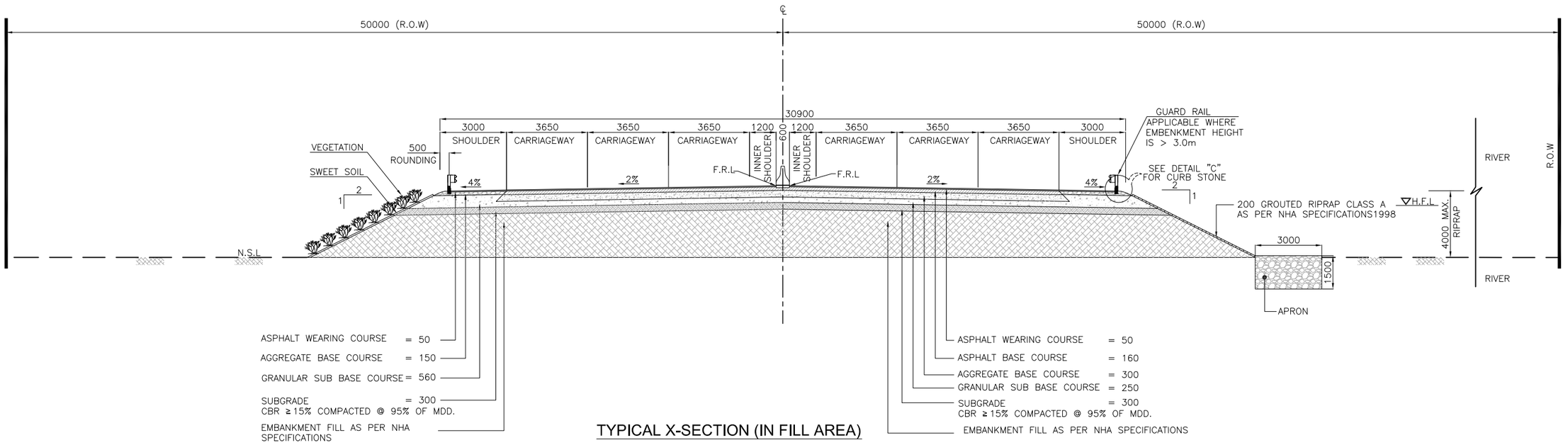
Expected rut depth in the base and/or subbase course = 8.78280E-02 inches

Expected rut depth in the roadbed soil = 9.46469E-03 inches

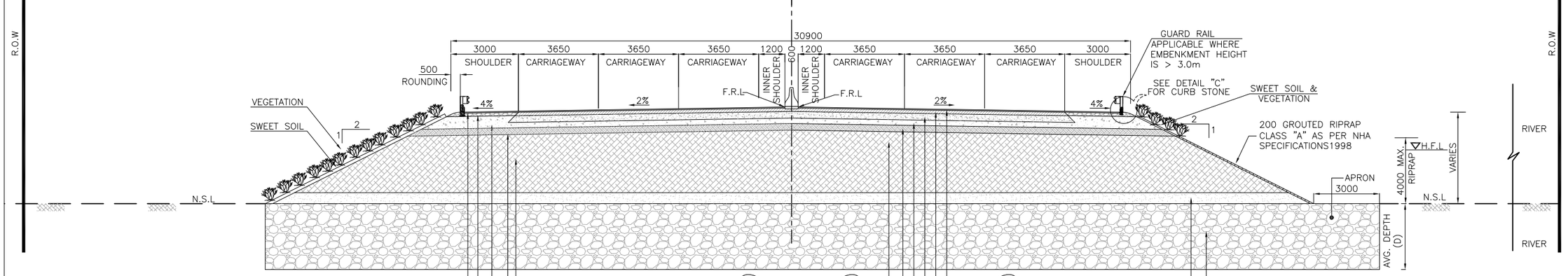
Caution: Thermal cracking of the pavement needs to be evaluated.

ANNEXURE-B

TYPICAL CROSS SECTIONS

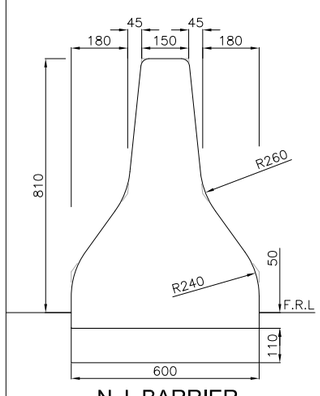


TYPICAL X-SECTION (IN FILL AREA)

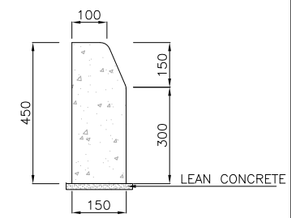


TYPICAL X-SECTION (IN WATER LOGGED AREA)

CHAINAGE	AVG. DEPTH OF BOLLDERS (D)
KM 3+500 TO 8+681	2.0 M
KM 9+586.5 TO 14+280.136	2.0 M



N.J. BARRIER



DETAIL "C" (PRECAST CURB STONE SECTION)

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER UNLESS NOTED OTHERWISE
2. ALL LAYERS SHALL BE PREPARED AS PER N.H.A.GENERAL SPECIFICATION
3. GROUTED RIPRAP PROTECTION UP TO 4.0 METER MAXIMUM. REMAINING PART EMBANKMENT SLOPE WILL BE PROTECTED WITH SWEET SOIL AND VEGETATION.
4. FOR ROCK BOULDERS FILL LAYER SEE THE TABLE MENTIONED BELOW THE SECTION (SLUSHY POND AREA).
5. ONLY APPLICABLE WHERE EMBANK-MENT HEIGHT IS MORE THEN 3.0m.

LEGENDS

REV.	REVISION/ISSUE	DATE

PROJECT:
MALIR EXPRESSWAY PROJECT

CLIENT:
LOCAL GOVERNMENT DEPARTMENT GOVERNMENT OF SINDH

E.P.C. CONCESSIONAIRE:
MALIR EXPRESSWAY (PVT) LTD

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Annex IV – Hydrology Report

Hydrology & Hydraulic Study
for
Malir Expressway



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SUMMARY

The current investigation has been carried out to study the hydrological regime and allied impacts in relation to the development of Malir expressway in Karachi area, Sindh province, Pakistan (approx 36 km in length). The proposed alignment falls in the eastern side of Karachi along Malir river originating from Kohistan/ Kirthar ranges and finally joins sea near Korangi Creek.

- The catchment of Malir River has a rugged terrain. The middle part is made of sediment deposits comprising of coarse, conglomerate and sand stone, clay-stone and limestone, while the lower plain is composed of alluvial deposits. In the lower plain the River is wider and shallower and it gets braided.
- The basin comprises of rocky waste-land covered with sandy soil. The vegetation is in the form of shrub trees and bushes. The lower part has good grass cover which gradually diminishes towards south and is full of orchards and vegetable patches.
- The climate of Malir River Basin is dominated by sea breezes throughout the year. May and October causes the highest temperatures up to 41°C and the coldest months are January and February, with the mean minimum temperature of 13°C. Maximum rainfall occurs during monsoon. The average annual rainfall of basin has been reported ranging from 10 mm to 150 mm.
- Besides providing a drainage system to the area, it supports agricultural activities as well. These agricultural activities have also invaded the riverbed at many places.
- There are several major tributaries of Malir river and mostly join in upper part of the basin. As no consistent flood and rainfall data from the catchment area was available therefore reliance have been made on historical studies and available data using latest modelling and GIS tools during the study. Although the scope of study proposes for 50 year standard flood however analysis have also provided for 100-year flood as generally recommended for such kind of infrastructure.
- Based on hydrological and hydraulic analysis, the alignment options have been studied while ensuring that the embankment height should not increase the existing embankments. The alignment without entering into Suman Village has been preferred as avoiding any litigation issues.
- In general, 6.0 m embankment height has been proposed with flood extent ranging from 500 to 600 m. Other side, embankment arrangements would not mainly require except at RD 16+500 to 17+700 where the people have encroached the river bed.
- The embankment design is proposed with slopes having berm provision to withstand in such areas where soils are sand dominant and settlement are

frequent phenomenon. A typical x-section is also provided as guideline having proper treatment of base and stone pitching along with riprap arrangements.

- For cross-drainage structures, it is recommended to retain all such culverts/ drains and structural arrangements should be made to connect/ continue under the Embankment while ensuring no back-water effects.
- In most of the cases, the embankment is to be raised 6.0 m as compared to adjoining areas. Therefore, to ensure drainage from the road itself, drop structures are proposed to be provided at about 50 m apart with proper riprap arrangements to avoid any rill development of the embankment. Therefore, the design guidelines for various components of chute spillway are also provided.

1. INTRODUCTION

1.1 Project Description

The infrastructure development including communication network, health services and other social facilities, has central role in the socio-economic uplift of the community, the nation and the country as a whole. All such developments require fundamental design considerations with the main objective to safeguard huge investments and precious human lives. The natural disaster especially floods and earthquakes generally have devastating effects on such infrastructures and demand shielding measures to avoid or atleast reduce the severity of any such episode. The current investigation was carried out to study the hydrological regime and allied hydraulic impacts in relation to the development of Malir Expressway (approx. 36 km) from Super Highway Bridge to Korangi Crossing The proposed alignment is shown in Figure 1.

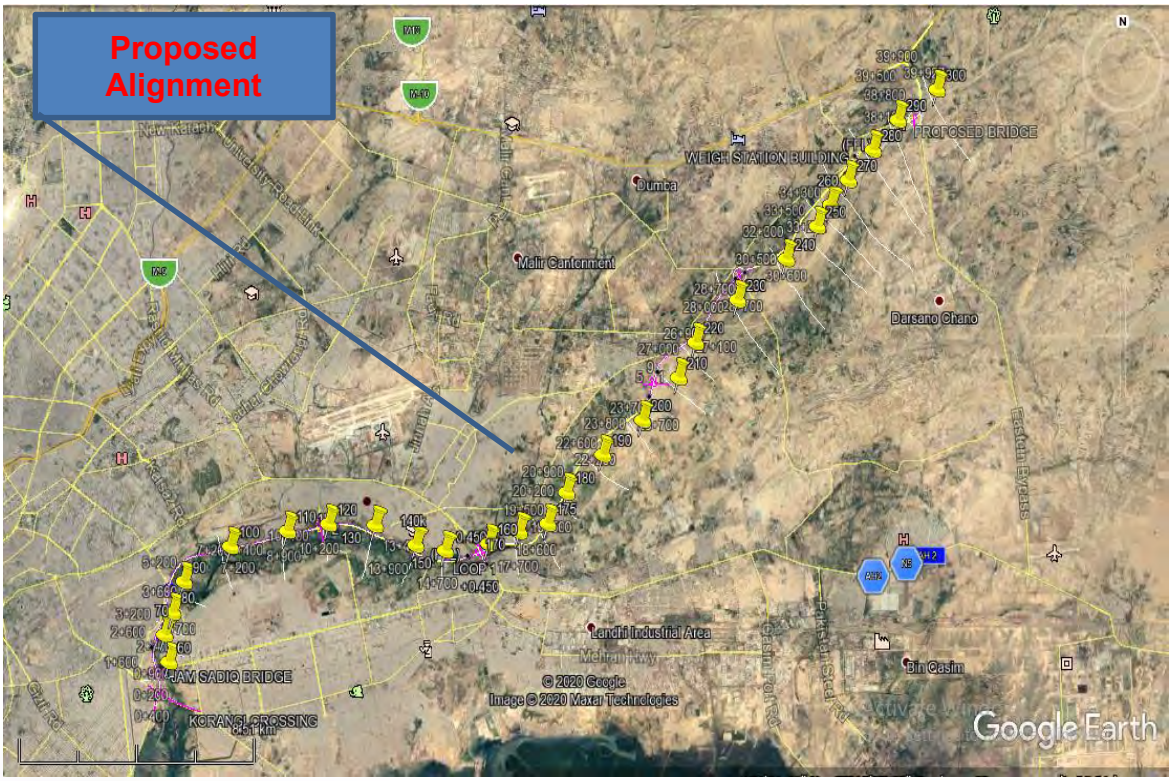


Figure 1: Proposed Alignment of Rawalpindi Ring Road

The main objective of this project is to offset the growing traffic congestion of Karachi being the largest metropolitan of the country. The growing urbanization and increasing population have put a lot of pressure on the existing infrastructure especially the urban transport system which barely caters the mobility needs of this mega city. The proposed alignment starting from M-9 Motorway (Karachi-

Hyderabad Super Highway) runs along/ within the Malir River would pass mainly through peri-urban and agricultural fields before entering into highly urbanized areas such as Shah Faisal Town, Mehboobabad, Defence Housing Authority and terminating before Korangi Crossing after Jam Sadiq Bridge. This alignment would not only connect M-9 Motorway to National Highway (N-5) running upto northern parts of the country but also a strategic expressway to serve as the southern alternative route for carrying traffic of the port and industrial areas to the main highways and will also provide speedy access to residential schemes along the route.

The subject hydrological investigation will look at the proposed alignment to identify safe passage against standard flood and drainage hazards, and accordingly propose flood protection, embankment height and cross drainage facilities along the proposed alignment. This would help for better planning and structural design considerations as the objective is to develop a sustainable road infrastructure along the proposed alignment. The development of this section would also help progress of the remote areas where most of the poor people are residing.



1.2 Scope of Investigation

The main objective of the study was to carry out hydrological and hydraulic studies with reference to the proposed Malir Expressway, expanding over an approx length of 36 km, from M-9 Motorway to Korangi Crossing. The specific scope of the study however is:

- Carryout the hydrological studies of Malir River for placement of alignment, height of embankment as well as protection of embankment to control erosion.
- Considering river flow pattern during peak flood for 50 years return period.
- Expressway embankment height should not be less than the existing protection bund top level already constructed from start up to Quaidabad bridge.
- The design should be based on findings and recommendations of Hydraulic study, flood level and its extent on both sides of Malir River.

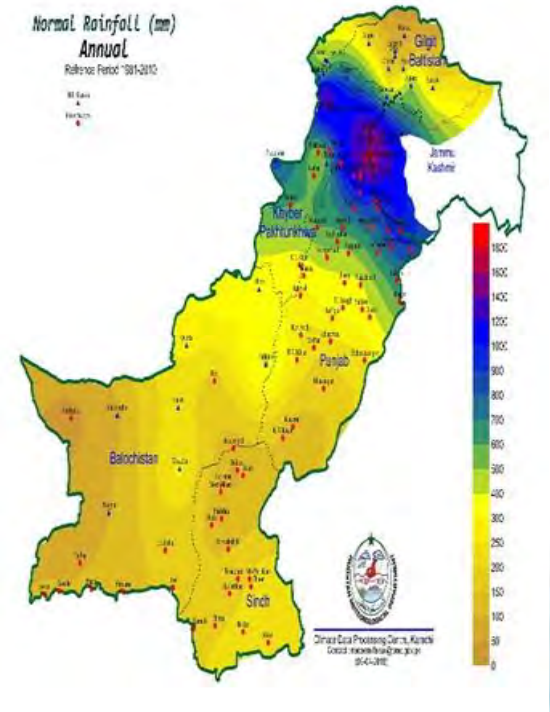
2. APPROACH & METHODOLOGY

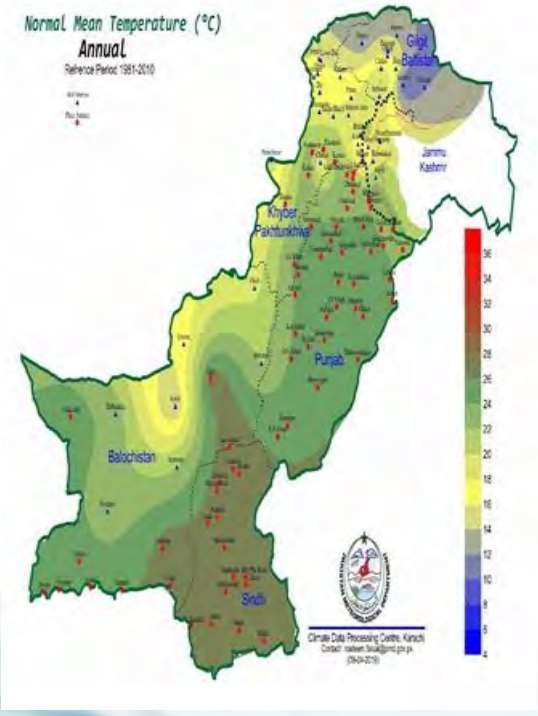
2.1 General

The study section of proposed alignment for Malir Expressway starts from M-9 Motorway to Korangi Crossing after Jam Sadiq Bridge, falling mainly in Karachi territory of Sindh Province of Pakistan. The study alignment area mainly falls in Karachi area where tropical climate encompasses warm winters and hot summers with humidity levels usually remain high from March to November. Whereas the Malir catchment mainly falls in Kohistan and Kirthar hills, and the climate is not noticeably different from the rest of Sindh, but it may feel a little hotter and drier in the summer season from March to August when temperatures are often extreme. The moist months are July and August during the monsoon season when rainfall occurs and makes this desert area greenest. In order to carry out the detailed hydrological-cum-hydraulic investigation, following approach and methodology were followed.

2.2 Reconnaissance and Data Collection

The proposed alignment falls in tropical climate with warm winters and hot summers whereas the Malir river catchment mainly falls in mountainous areas of Kohistan and Kirthar hills, and the climate is little hotter and drier in summer season when temperatures are often extreme. The moist months are July and August during the monsoon season when rainfall occurs. The area on average receives annual rainfall of 200 to 250 mm annually with average normal temperature 30 ºC or more.





The catchment of Malir River area has a rugged terrain. The middle part is made of sediment deposits comprising of coarse, conglomerate and sand stone, clay-stone and limestone, while the lower plain is composed of alluvial deposits. In the lower plain the River is wider and shallower and it gets braided. The basin comprises of rocky waste-land covered with sandy soil. The vegetation is in the form of shrub trees and bushes. The lower part has good grass cover which gradually diminishes towards south and is full of orchards and vegetable patches. The average monthly rainfall pattern shows July to September having maximum rainfall and trend decrease towards Hyderabad (Figure 2). There is also significant variation of rainfall within Karachi as experienced during recent 2020 flood condition (Figure 3). May and June are having maximum temperature which increases towards Hyderabad (Figure 4).

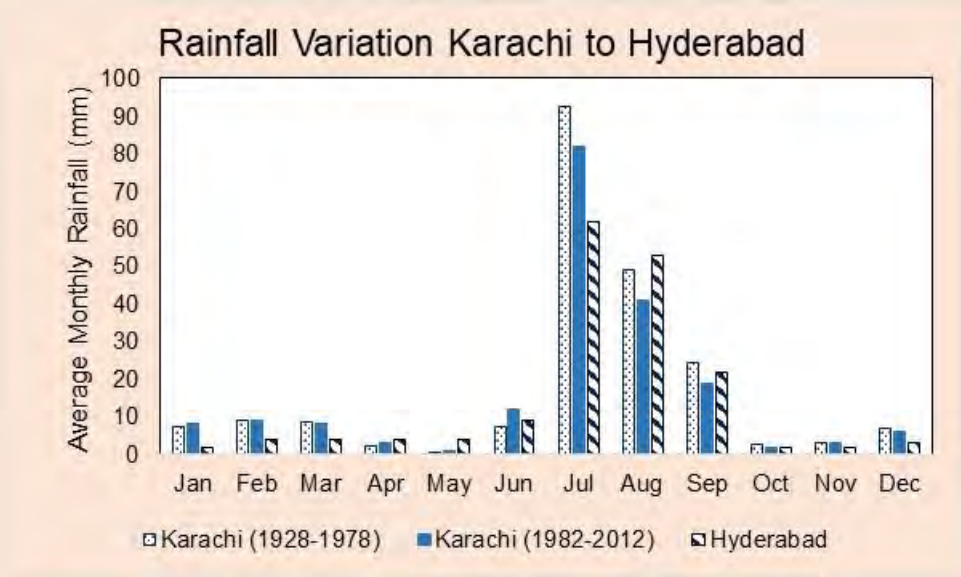


Figure 2: Areal Rainfall Variation (Karachi towards Hyderabad)

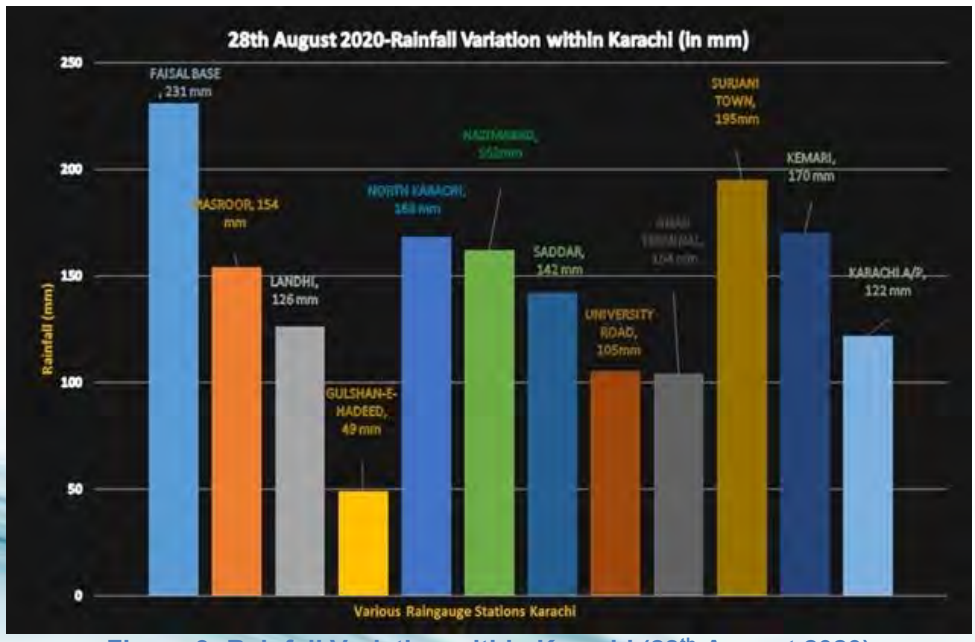


Figure 3: Rainfall Variation within Karachi (28th August 2020)

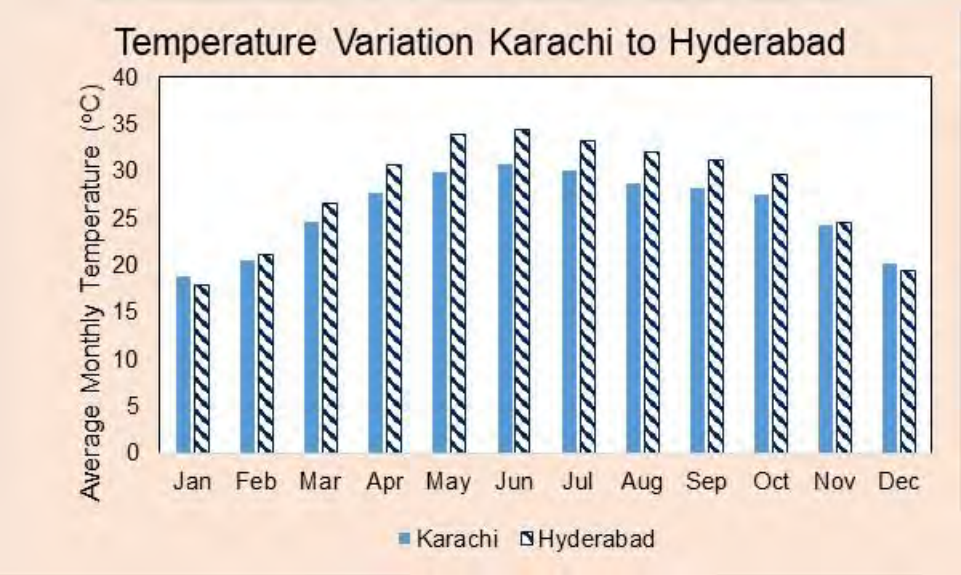


Figure 4: Temperature Variation (Karachi to Hyderabad)

In order to carry out the subject hydrological and hydraulic investigation, the relevant information and data was gathered from relevant departments and organizations for the study area besides conducting field surveys and physical investigations by team of Experts, Engineers and Surveyors;

- Acquiring latest topo-sheets especially of scale 1:250,000 and 1:50,000 from Survey of Pakistan (SOP)
- Latest RASTER maps (atleast 30 meters) of the area where the alignment is proposed
- Exploring technically appropriate climatic stations with sufficient length of climatic observations (atleast 25 to 30 years) especially rainfall and temperature (max, min) atleast daily for acquiring data from Pakistan Meteorological Department and/or any other reliable agency in the study area.
- Major natural/ flood streams and rivers crossing and/or in the vicinity of the proposed alignment with information of historical discharges (if available), flood inundation and marks, and x-sections from relevant departments (Irrigation Department, WAPDA, Highways Department etc.)
- Feasibility Report Karachi Flood Control Plan, WAPDA, 1983 (updated in Nov 1990).
- Information of existing structures along the proposed alignment
- Water quality data of related rivers/ steams where available
- Latest land use, soil and geological maps from the concerned agencies (SOP, GSP, FAO etc.)
- Relevant standard for clearance and freeboards, and
- Any relevant study already conducted or information available from the area.

The analysis and outcomes are presented in the coming parts of this report.

3. HYDROLOGICAL INVESTIGATION

3.1 Hydrological Investigation

The hydrological investigation under the current study was carried out to analyze the climatic variability coupled with flow regime in connection with the development of Malir Expressway. For such investigation, it is needed to take all necessary deign and protection measures for safe development and operation of the road till the service life. The design considerations and measures may include: studying hydrological regime and rainfall-runoff analysis, appropriate embankment and capacity of drainage structures, bridges to safely pass the standard flood (50 or 100-year return period) and protection against possible flooding and inundation impacts.

For hydrological analysis, there could be two different approaches or sometimes the combination of both to analyze the standard flood viz. i) Discharge frequency analysis using observed data, and/or ii) well practiced and acceptable rainfall-runoff methods making use of observed rainfall which is mostly available along with physical characteristics of the watersheds from where the runoff is generated.

Malir river is one of the three major streams in Karachi, flowing in the eastern side. The total area of the Malir River Basin is 2251.7 km^2, out of which 930 km^2 is located within the city's boundaries. Malir is a non-perennial stream and the second most extensive river system of the region with more than nine tributaries. The climate of Malir River Basin is dominated by sea breezes throughout the year. May and October causes the highest temperatures up to 41°C and the coldest months are January and February, with the mean minimum temperature of 13°C. Maximum rainfall occurs during monsoon. The average annual rainfall of basin has been reported ranging from 10 mm to 150 mm (1985-2014) based on data provided by Pakistan Meteorological Department (Sumaira and Arjumand, 2019). Besides providing a drainage system to the area, it supports agricultural activities as well. These agricultural activities have also invaded the riverbed at many places.

The major tributaries as headwater areas of Malir river are comprised of Mol (615.37 km^2) and Khadeji (543.59 km^2) tributaries, originating from Kohistan/ Kirthar hills, on its way other streams like Sukkan and Thado upto National Highway Bridge where urban congestion has affected much of the river bed. After flowing through major urban localities such as Shah Faisal Town, Mahmoodabad, DHA, two small nullahs (Peer Bukhari Shah-10.8 km^2 and Chakora 43.5 km^2) joins before the river enters into sea at Korangi Creek.

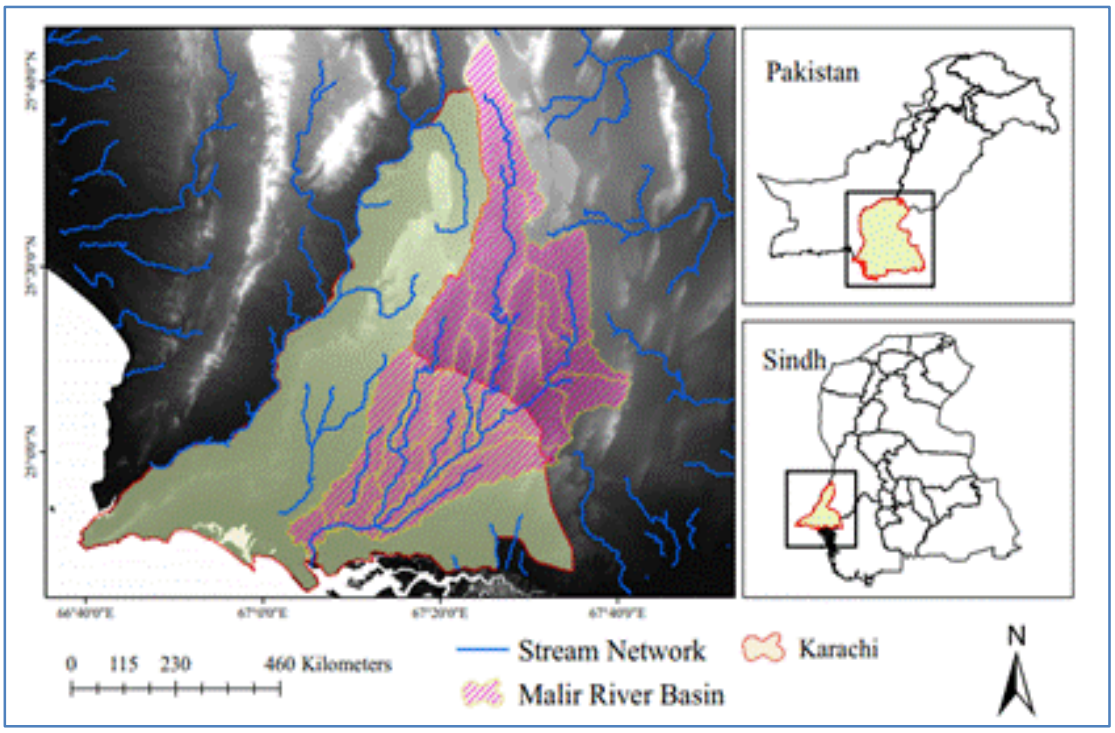


Figure 5: Karachi and Malir River Basin (Source: Sumaira and Arjumand, 2019)

As such no long term flow record is available from the main river and its tributaries except for few flood records. One of the major study was carried out by WAPDA (1983; 1990) titled Feasibility Report Karachi Flood Control Plan. Under this study despite scarcity of data, standard flood estimates were made for various tributaries and main river. The long term rainfall data available for the study was from Karachi Airport (1943-1976) and some data collected during the study at other locations of the basin (Thana Shah Beg, Sari Sang and Super Highway Bridge). That study adopted the approach of storm maximization while studying isohyetal pattern coupled with unit hydrograph method to estimate the standard floods for various sub-catchments of Malir river basin.

Table 1: Standard Flood Estimates for Malir river and its tributaries (Source: WAPDA 1983 & 1990)

Catchment	Area	Flood Estimates	
	Km^2	50-year	100-year
Mol	615.37	52,000	101,000
Khadeji	543.59	80,000	134,000
Mol+Khadeji	1158.96	132,000	235,000
Chakora	43.52		9,000
Peer Bukhari Shah	10.80		2,169
Malir river	2251	240,000	409,000

Whereas historical floods of July 1977 and August 1978 were estimated as 120,000 cusecs and 90,000 at Super Highway bridge as combination of flows from Mol and

Khadeji tributaries, respectively. The 1977 flood estimate at National Highway Bridge was approx. 200,000 to 250,000 cusecs. Whereas during 1978 flood, the peak of 200,000 to 230,000 cusecs was estimated passed at this location which ranges from 20 to 50 year return period.

Attempt was made during the current study to estimate the standard flood using more data and latest techniques as described in coming sections.

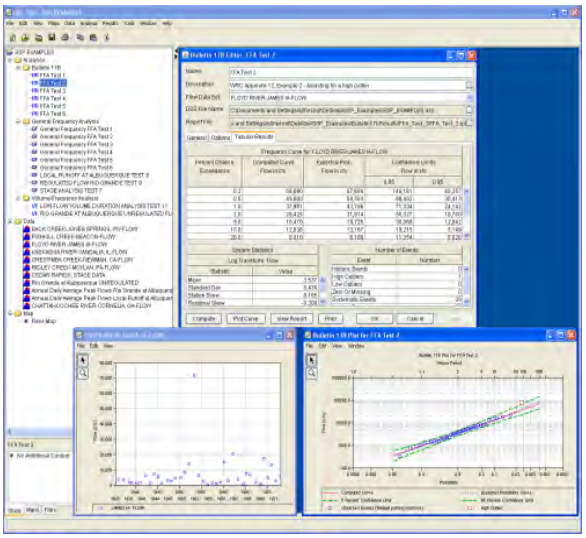
3.2 Rainfall Frequency Analysis

The historical floods records if available plays significant role in hydrological studies to analyze the flood threat from nearby or crossing rivers/ streams to a point of interest in terms of flood magnitude, its inundation effects and flood levels (HFL). This allows deciding viable embankment height for road infrastructure and also suggesting x-drainage structures and protection measures. As no long term flood data was available therefore, rainfall frequency analysis was carried out using extremen rainfall events from long term record available for Karachi Airport (1967 – 2020).

Such analysis was required to be carried out where observed long term records are available, to know the magnitude of standard flood which in case of large bridges/ rivers is 100 or 50-year recurrence interval whereas for small structures like small bridges and culverts would be 25 to 50-years. For such estimations, the frequency analyses were carried out and generally used probability distributions for such purposes are;

- Normal
- Log Normal
- GEV
- Gumbel

In most of the cases, Type-I i.e. Gumbel Distribution for extreme events (a two parametric distribution) is used which is well suited for most Pakistani catchments especially relating flood frequency analysis. Generalized Extreme Value Distribution (GEV) is mostly used where long term records are available. However, the selection of distribution (e.g. Normal, 2 Parameter Log Normal, 3 Parameter Log Normal, Gamma, and Gumbel) was based on Mean Relative Deviations (MRD) which best fits the observed data.



The frequency analysis of observed maximum rainfall events (daily) were carried out using widely accepted HEC-SSP software developed by US Army Corps of Engineers.

The frequency analysis of observed annual maximum rainfalls for Karachi (taking as representative station for the study area) are shown in Figures 6 to 7. Based on such frequency analysis, the standard estimates were drawn under the current study in the light of long term rainfall data availability (1967-2020). The GEV distribution offers less risk for higher return periods in case of large data sets whereas for shorter data length, the Gumbel gives more reasonable estimates with confidence for larger return periods. Therefore, the estimates with Gumbel were adopted for further analysis based on minimum residual/ best fit. The standard rainfalls are drawn in Table 2 for 50 and 100 year return periods.

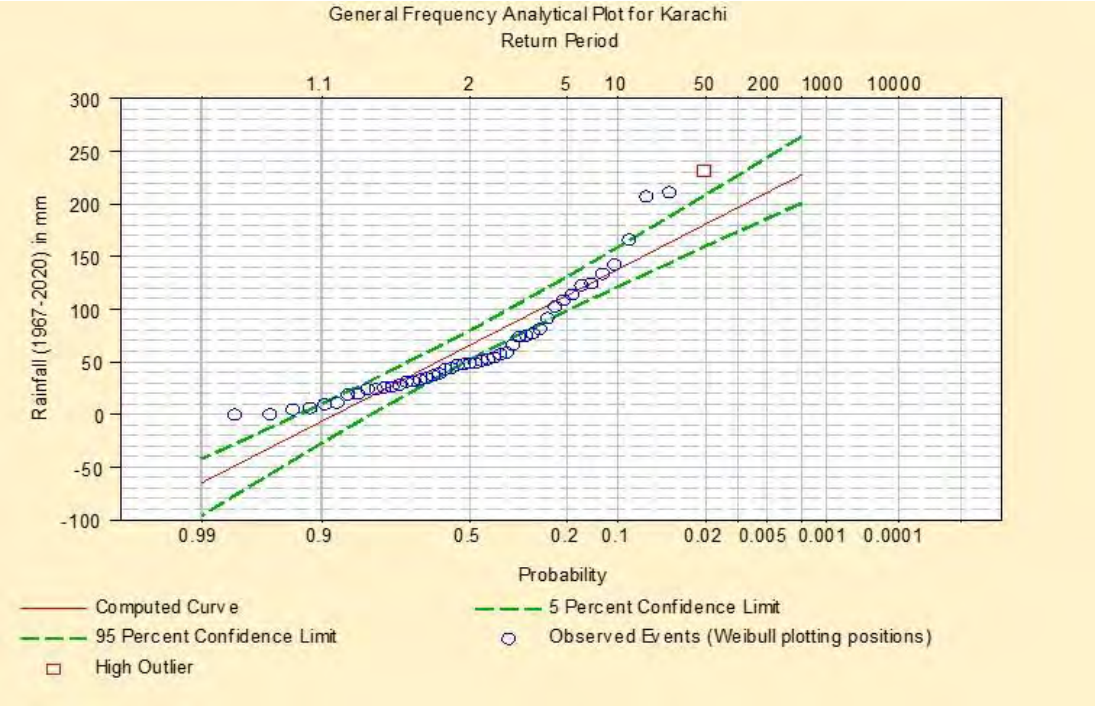


Figure 6: Rainfall Frequency curve for study area (Gumbel distribution)

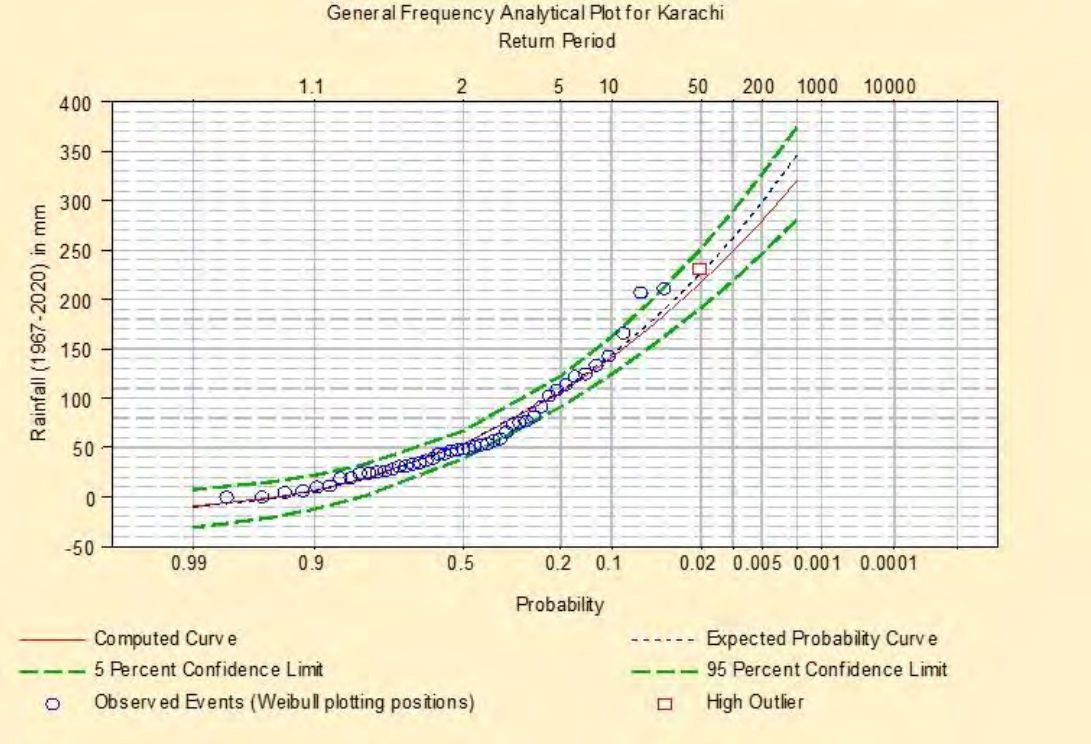


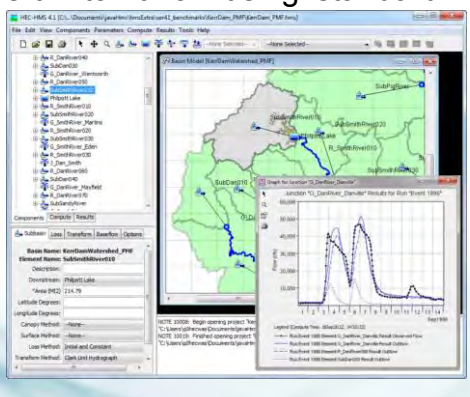
Figure 7: Rainfall Frequency curve for study area (GEV distribution)

Table 2: Standard Rainfall Estimates for Study area (in mm)

Distribution	Return Period	
	50-Year	100-Year
Gumbel	181	198
GEV	219	251
Recommended	181	198

3.4 Rainfall-runoff Analysis

These standard rainfalls were then used to convert into runoff using standard rainfall-runoff methods such as;



- Rational Formula for small catchments of few acres;

$$Q = CIA$$

where
Q= Peak Discharge in Cusecs,
C=Coefficient of Discharge,
I= Rainfall Intensity (inches/hours),
A= Catchment Area in Acres

Other methods are based on Unit Hydrograph approach and widely used as;

- Snyder Unit Hydrograph Method,
- SCS Synthetic Unit Hydrograph method.

Due to wider application, more representative of catchments response, and less data intensive, SCS Synthetic Unit Hydrograph method was used while applying HEC-HMS computer model to simulate standard discharge of desired return periods at points of interest along the proposed alignment. The SCS method makes use of catchment characteristics and land use for transforming rainfall into discharge.

For this purpose, GIS applications were made for estimating the catchments characteristics (watershed area, main stream length, average slope, land use etc.) to be used in the model.

The well-defined methodology for catchments delineation was applied as mostly recommended procedure and technique making use of DEM based watershed modeling and ArcGIS tools as detailed below;

- Analyzed topographic variations along the proposed alignment on topographic sheets (1:250,000 scale) for identification of nullah, stream or area which may affect the road or need drainage
- Identified the relevant nullah and streams on Google Earth
- Then performed watershed delineation through SWAT (Soil and Water Assessment Tool) model using 30 meter DEM (digital elevation model)
- Then from model generated watersheds and stream network, analyzed the flow patterns through nullah and streams and identified their catchment areas in ArcGIS software, and
- Then calculated model based actual catchment area and other characteristics (stream length, slope) through ArcGIS software.

Based on watershed delineation, the discharges were determined making use of rainfall-runoff model application by HEC-HMS as given in Table 3 for entire Malir basin and also upper part of basin which bring most of the flow to downstream areas. All such discharge estimates, were then studied through hydraulic analysis presented in the coming sections. This was done in order to see the impacts to the alignment and accordingly the protective measures and design parameters were proposed for necessary drainage structures.

Table 3: Flood Estimates under current study

Catchment	Area (km^2)	Standard rainfall (mm)	Flood Estimates
Malir Catchment	2251.70	P100=198 P50=181	Q100= 220,673 cusecs Q=50=198,069 cusecs
Upto Super Highway	1463 (65% of Malir Catchment)	P100=198 P50=181	Q100= 182,770 cusecs Q=50=163,647 cusecs

4. HYDRAULIC INVESTIGATION

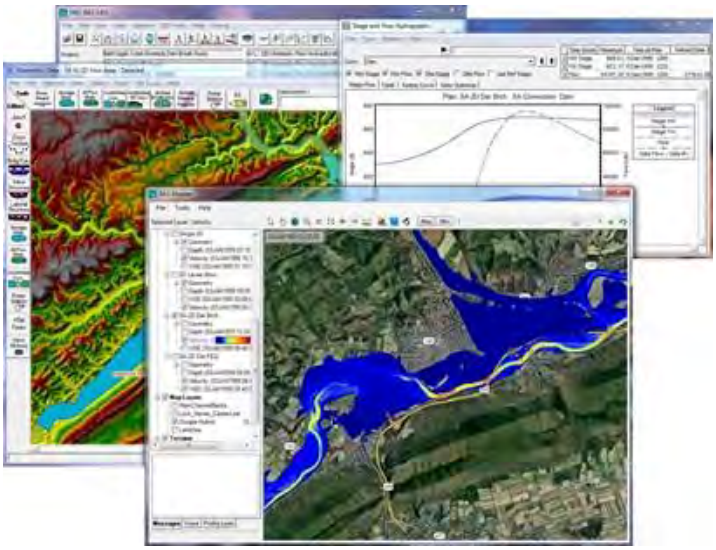
4.1 Hydraulic Analysis

The flood inundation is one of the major threats to road infrastructure which generally affects its operation besides resulting damage to its infrastructure and sometimes loss of precious human lives. For that purpose, embankment and drainage structures like bridges and culverts are provided based on the extent of flood size and associated threat.

The main objective of hydraulic investigation was to analyze the behavior of potential floods especially for placement of embankment. This helped for assessing the flood behavior/ inundation extent and suggest measures under given potential flood conditions

4.2 Hydraulic Analysis for Major Drains, Streams and Rivers

The main objective of this investigation was to analyze the behavior of potential flood and flows passing through Malir river and placement of alignment of Malir Expressway. Using detailed topographic, cross sectional and longitudinal profile data, the flood behavior/ inundation extent was studied under the study for the proposed alignment.



In order to study the flood behavior, the hydraulic analysis was carried out using HEC-RAS Hydraulic Model because of its wide range applicability. The US Army Corps of Engineers' River System (HEC-RAS 5.01) model allows performing multi-purpose one and two-dimensional steady and unsteady flow river hydraulics analysis

In order to model the potential floods behavior through the river within channel and flood plain, the following data were provided as input to HEC-RAS model;

- X-sectional data atleast 50 m to 100 m apart/ intervals;
- Existing structures and protections
- Average slope of different reaches
- Magnitude of flood/ discharge (50 years, 100-year) at the starting point of each study reach (as per Table 3)

- Known HFL levels, physical field visits etc. for calibration/validation purposes.
- FGL from the alignment and ground NSL.

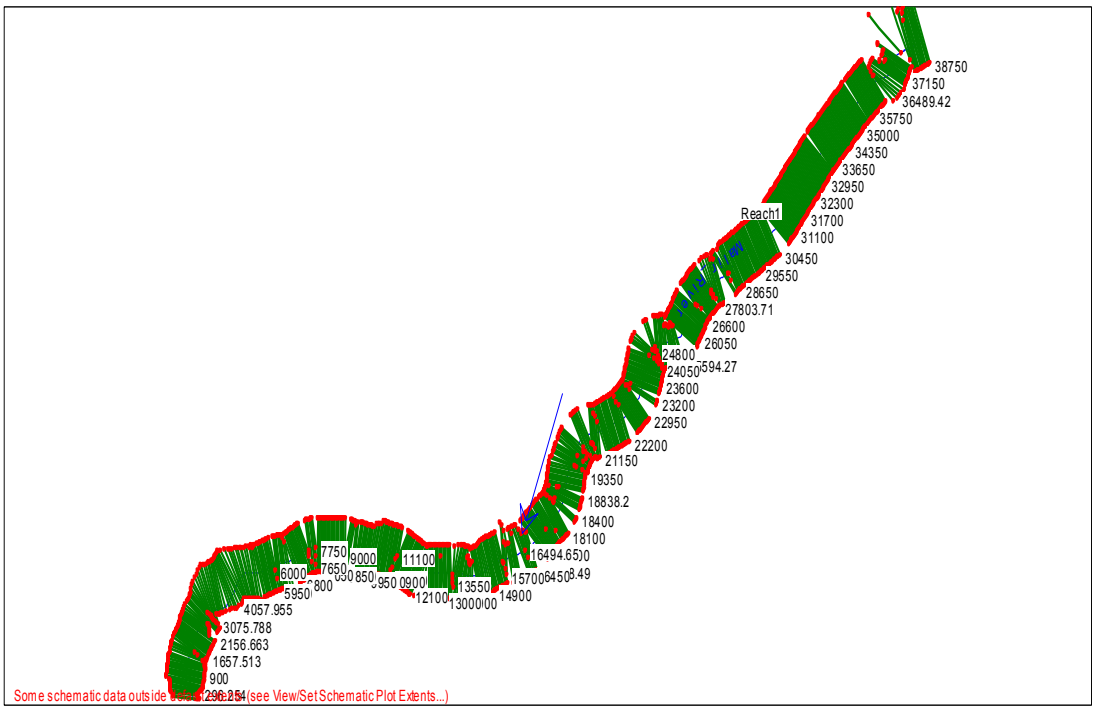


Figure 8: HEC-RAS Model Development for Study Alignment

The model was set up for calibration and validation processes simultaneously, and then hydraulic model results were analyzed to know the HFLs, flow depth and flood extent. The hydraulic model outcome for the entire study reach is shown in Figure 9 whereas the HFLs and other parameters in Figures 10 and 11.

The analysis shows slight difference in HFLs w.r.t 100 year and 50 year flood values, even for historical flood of 250,000 cusecs (Figure 10). However, the comparative analysis if max flood depths and flood extent shows a range of 4 to 6 m flow depth with flood extent on the range of 500 to 1000 m depending on the x-section shape and bed condition. This also suggests the embankment height upto 6 m maximum. In order to ascertain such findings further analysis was carried out

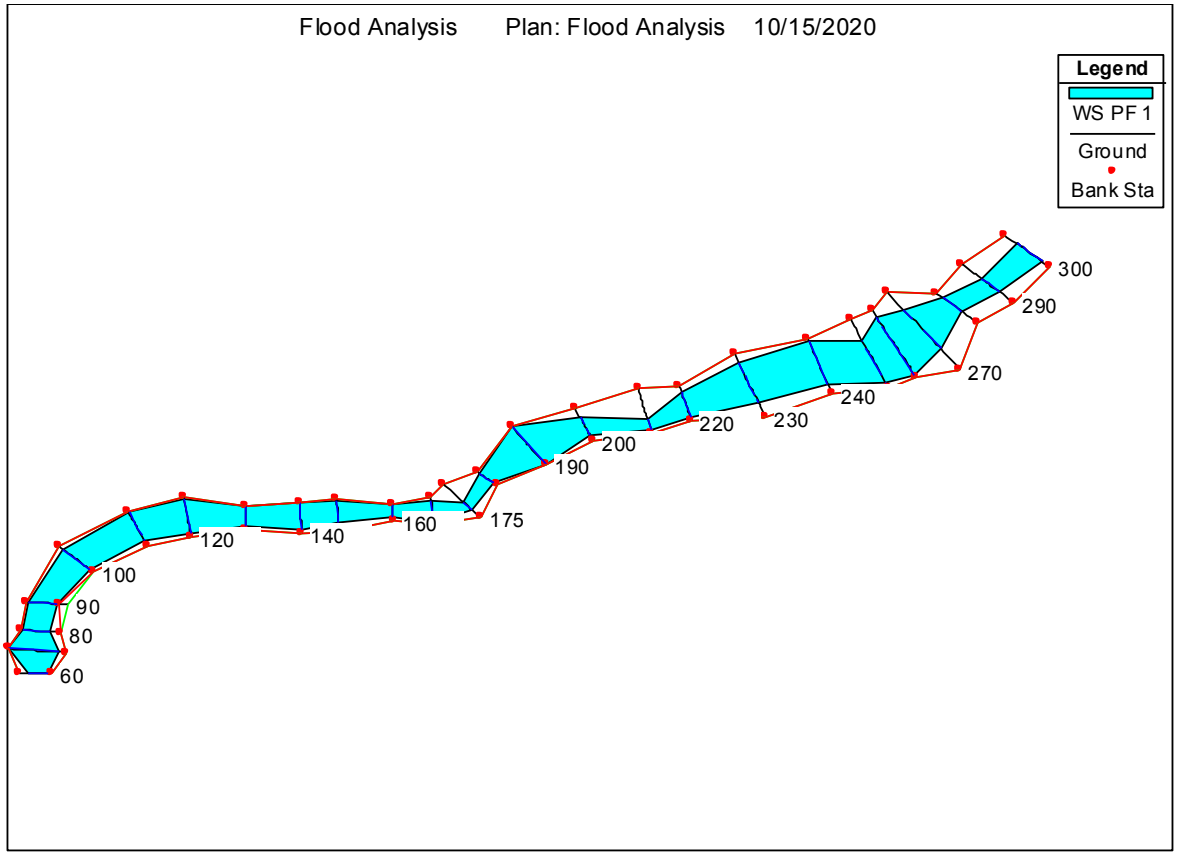


Figure 9: HEC-RAS Model Outcome showing Flood Extent

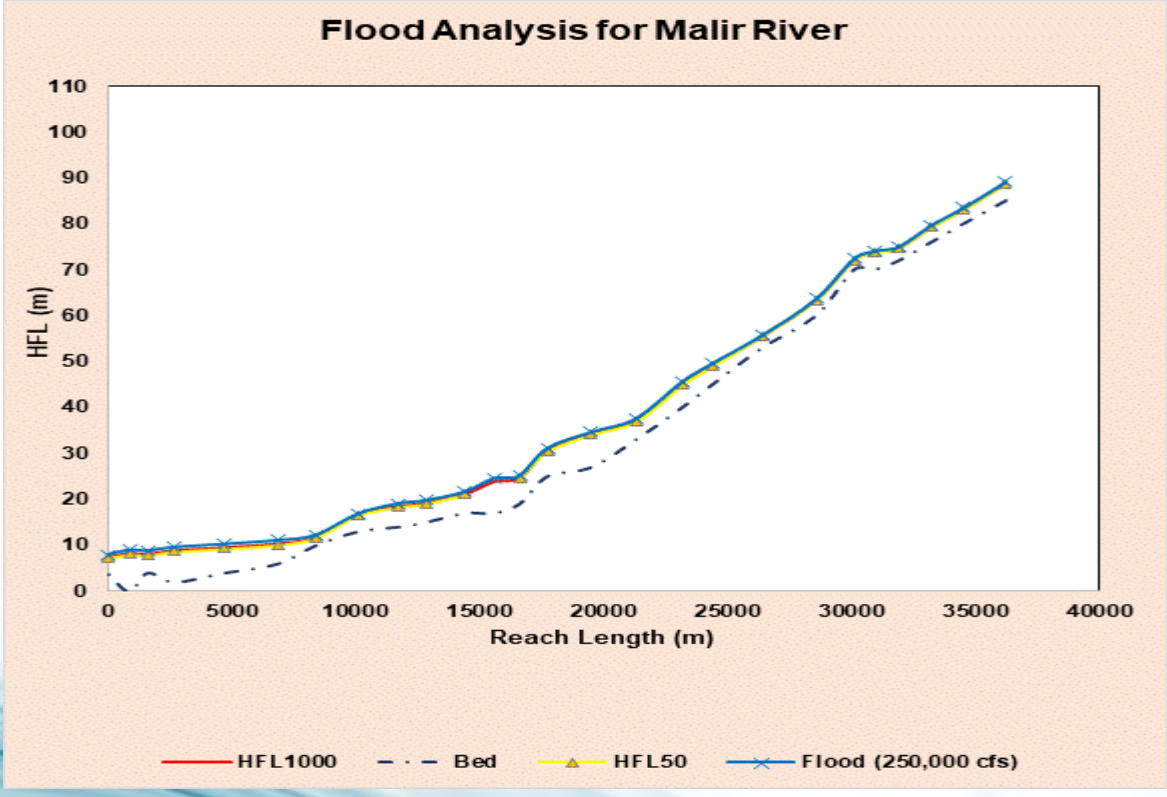


Figure 10: Outcome of Model Study for HFLs for NMalir River (50 and 100 Years)

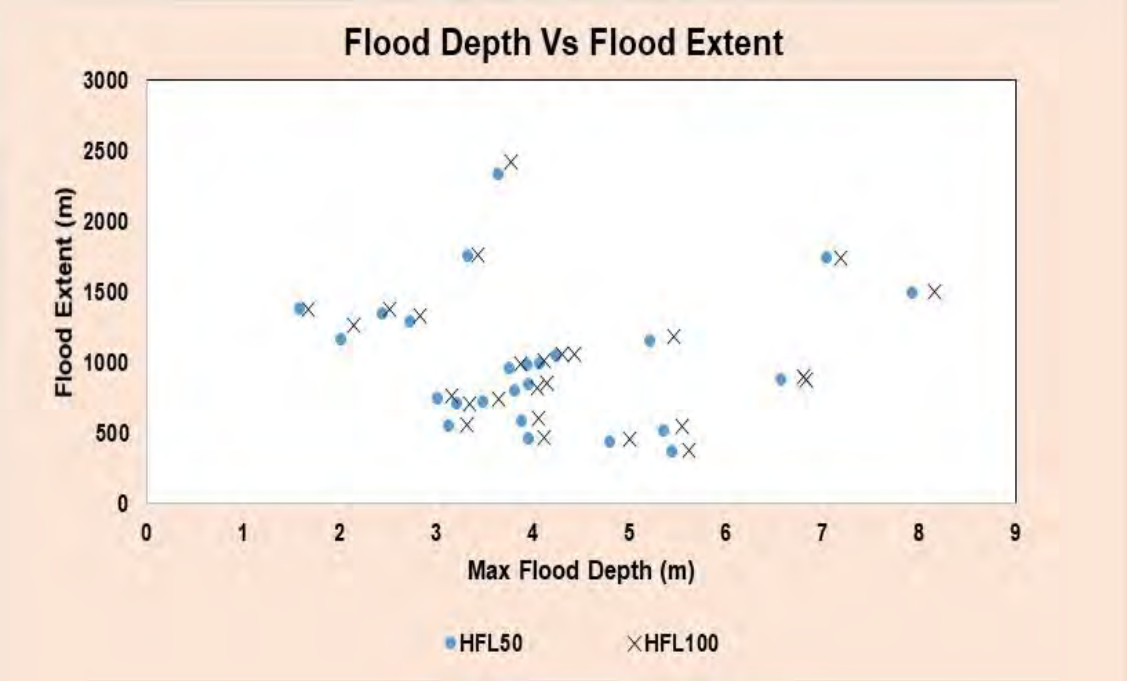


Figure 11: Flood Depth Vs Flood Extent

There were two options of alignment (Annexure-B):

1. One with passing through Suman Village, and
2. Second remaining within the river to avoid Suman Village

The second option is the extreme case which was studied as going through Suman Village is a small portion which automatically would be covered. Therefore, the x-sections were adjusted by placing the 2nd option of alignment and embankment in a way that height should not increase the existing embankment there. The HEC-RAS model analysis were then carried out for Q100 and Q50 years both and the HFLs were compared with the HFLs of 250,000 cusecs. The model outcome is shown in Figure 12 whereas the comparison of HFLS in Figure 13. The comparison shows that the HFLs with embankment are not higher than the 250,000 cusecs flood and there was not case of exceeding existing embankments.

The comparative analysis of maximum flood depth with flood extent (Figure 14) shows that the flow depth is not more than 6.0 m in almost all of the cases. One exception is the lowest point at the start where actual x-section measurement would solve the problem as bushes sometimes insert anomalies while extracting data from RASTER/ DEM application. similarly, flood extent is between 500 to 600 m in general for which at some places where people have encroached the river bed, need to be shifted upward otherwise building high embankment in that portion

would not solve the problem rather creating restriction to the flood resulting damages downstream especially at RD 16+500 to 17+700.

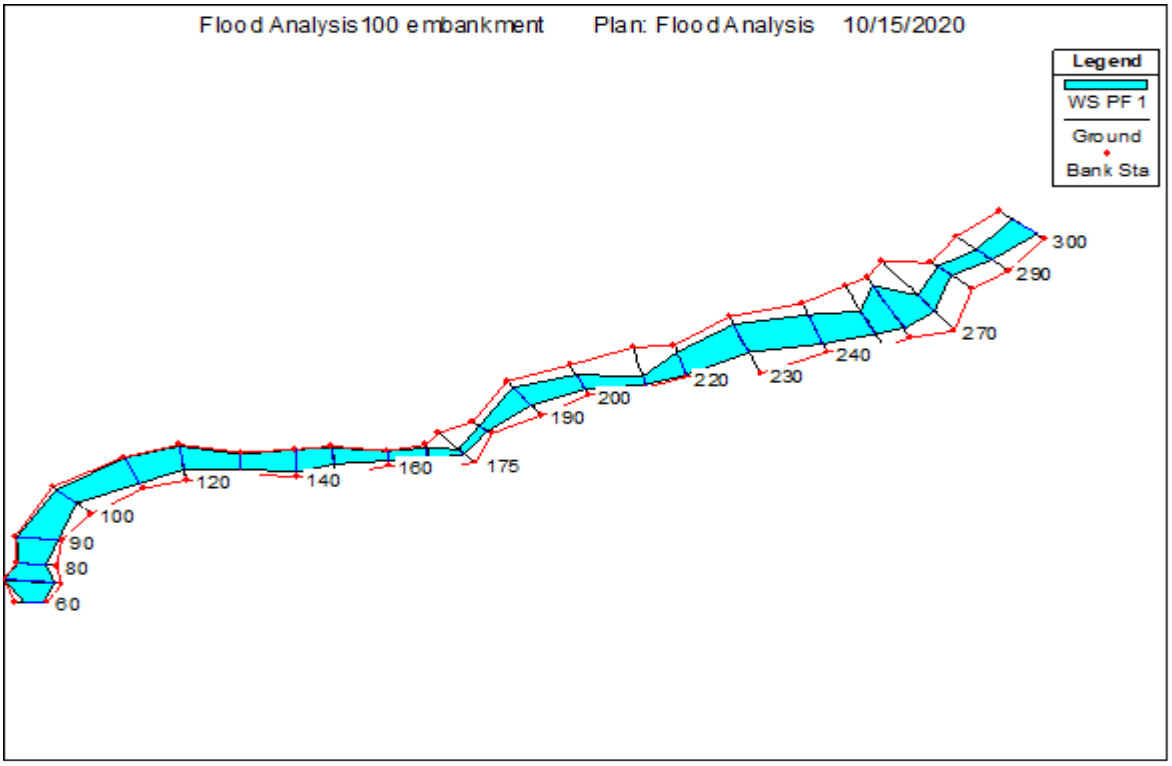


Figure 12: Model Output for Malir River with Embankment

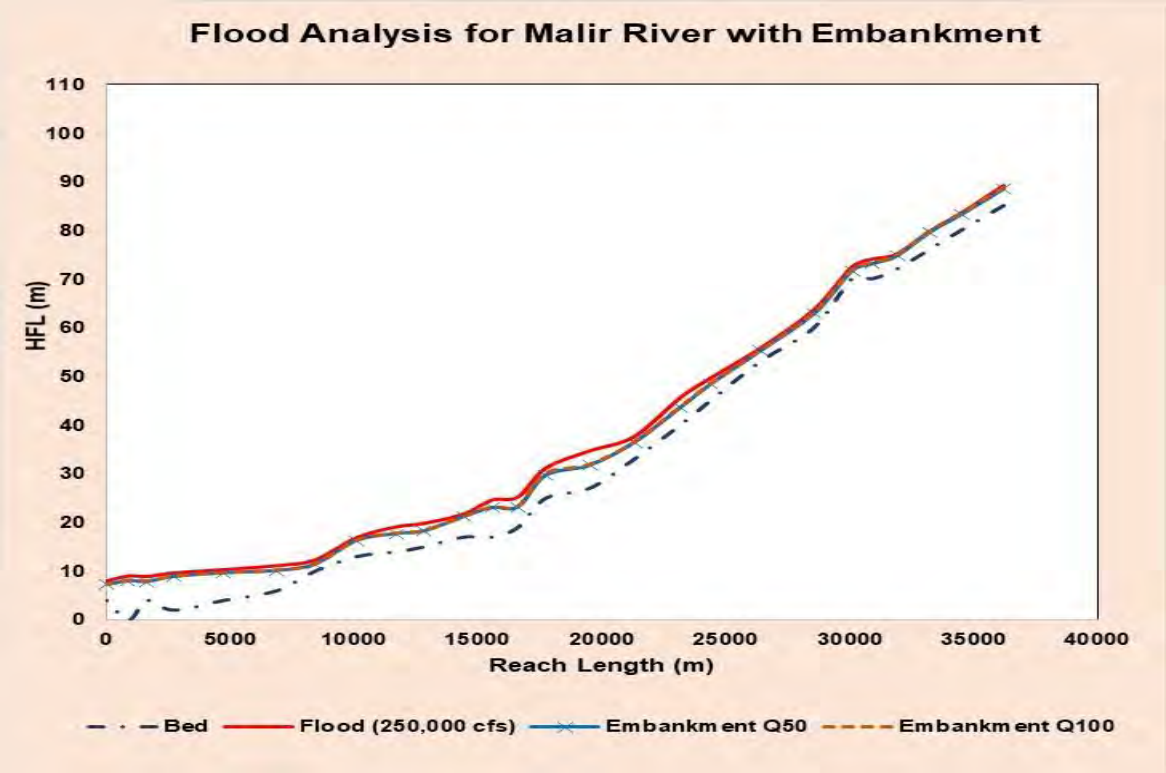


Figure 13: Flood Analysis of Malir River with Embankment

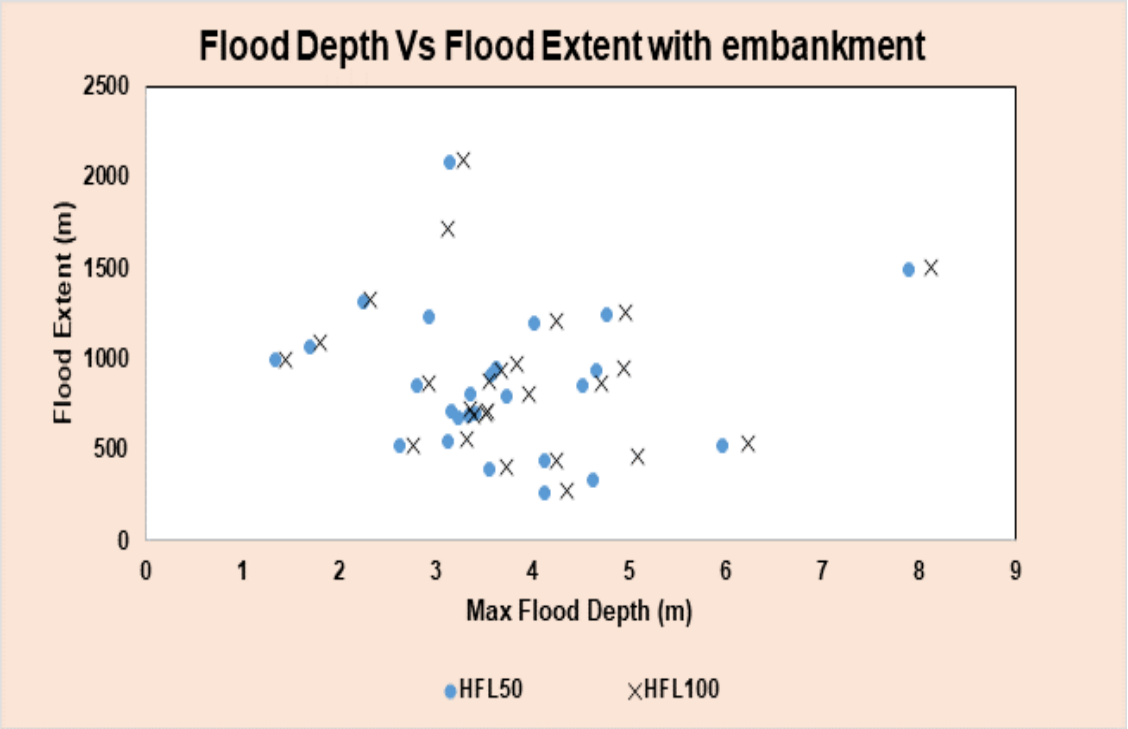


Figure 14: Comparison of Flood Depth Vs Flood Extent After Embankment

4.3 Hydraulic Analysis for Cross-Drainage Structures/ Culverts

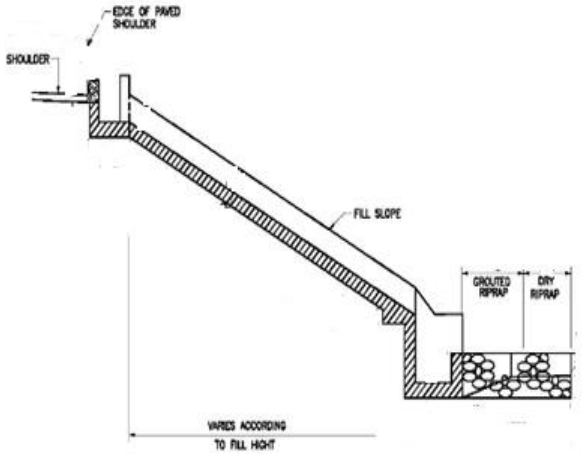
On the basis of inundation analysis and cross-drainage needs (existing or new) at the point of interests along the proposed alignment, it was analyzed to identify the locations requiring drainage of having existing drains as cross-drainage structures/ culverts to safely pass flow of certain magnitude (25 to 50 years as optimum criteria) to withstand the embankment as well as smooth operation of the road under such standard flood conditions.

In this regard, it is recommended to retain all such culverts/ drains and structural arrangements should be made to connect/ continue under the Embankment while ensuring no back-water effects.

4.4 Hydraulic Design Analysis for Road Drainage



Storm water management of roads itself needs to be integrated with management of surrounding land and development. However, the drainage of runoff from the road itself should be so designed to avoid any pondage on the road surface for safe operation of the highways.



Adequate cut-off must be provided such that the maximum length of flow path in the road drainage channel does not exceed up to a reasonable length, preferably 200m. The cut-off must discharge to a natural watercourse or adjoining fields.

In most of the cases, the embankment is to be raised 6.0 m as compared to adjoining areas. Therefore, to ensure drainage from the road itself, drop structures are proposed to be provided at about 50 m apart with proper riprap arrangements to avoid any rill development of the embankment.

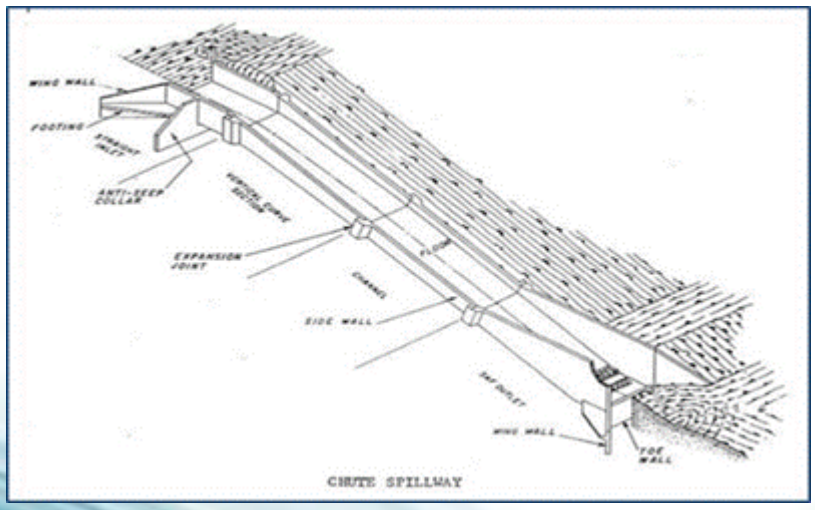


Figure 15: Schematic of Chute Spillway

The embankment design is proposed with slopes having berm provision to withstand in such areas where soils are sand dominant and settlement are frequent

phenomenon. A typical x-section is shown in Figure 16 but on river side, proper treatment of base and stone pitching should be ensured with riprap arrangements.

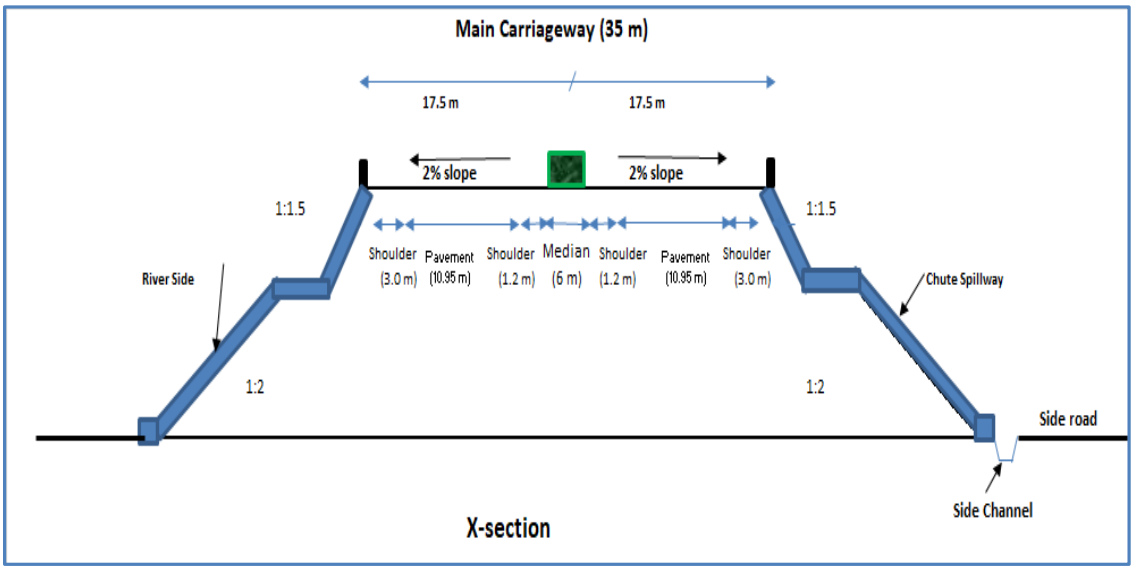


Figure 16: Typical X-Section of Embankment

Similarly, design guidelines for various components of chute spillway are also provided in Figure 17 below.

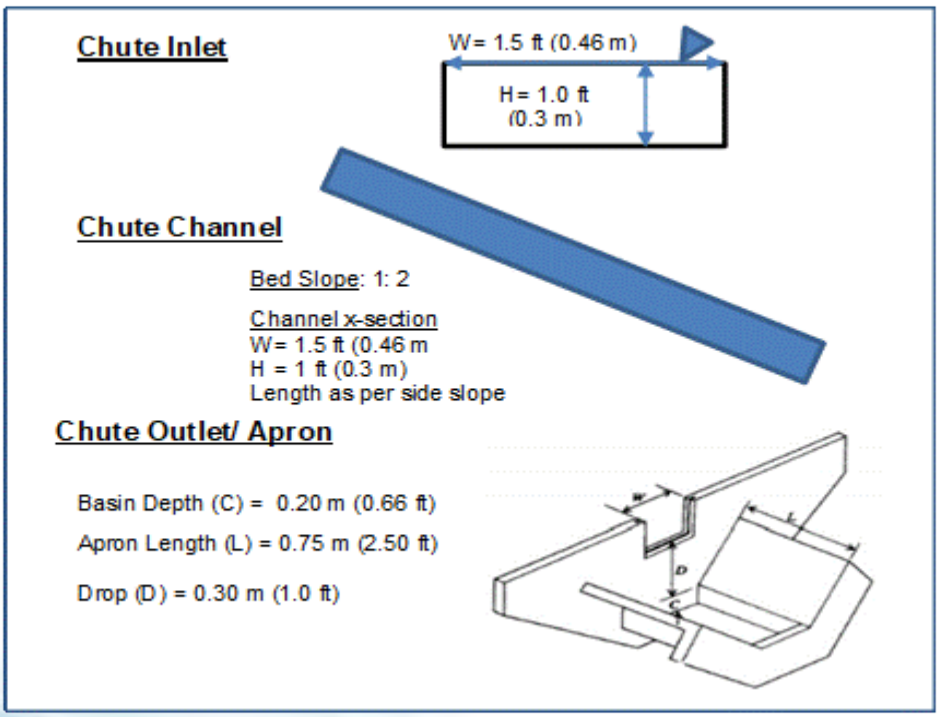


Figure 17: Design parameters of components of Chute Spillway

5. FINDINGS AND RECOMMENDATIONS

On the basis of data synthesis and analysis, major findings and recommendations of the study relating proposed Malir Expressway are as below;

- The proposed alignment falls in the eastern side of Karachi along Malir river originating from Kohistan/ Kirthar ranges and finally joins sea near Korangi Creek.
- The catchment of Malir River area has a rugged terrain. The middle part is made of sediment deposits comprising of coarse, conglomerate and sand stone, clay-stone and limestone, while the lower plain is composed of alluvial deposits. In the lower plain the River is wider and shallower and it gets braided.
- The basin comprises of rocky waste-land covered with sandy soil. The vegetation is in the form of shrub trees and bushes. The lower part has good grass cover which gradually diminishes towards south and is full of orchards and vegetable patches.
- The climate of Malir River Basin is dominated by sea breezes throughout the year. May and October causes the highest temperatures up to 41°C and the coldest months are January and February, with the mean minimum temperature of 13°C. Maximum rainfall occurs during monsoon. The average annual rainfall of basin has been reported ranging from 10 mm to 150 mm.
- Besides providing a drainage system to the area, it supports agricultural activities as well. These agricultural activities have also invaded the riverbed at many places.
- There are several major tributaries of Malir river and mostly join in upper part of the basin. As no consistent flood and rainfall data from the catchment area was available therefore reliance have been made on historical studies and available data using latest modelling and GIS tools during the study. Although the scope of study proposes for 50 year standard flood however analysis have also provided for 100-year flood as generally recommended for such kind of infrastructure.
- Based on hydrological and hydraulic analysis, the alignment options have been studied while ensuring that the embankment height should not increase the existing embankments. The alignment without entering into Suman Village has been preferred as avoiding any litigation issues.
- In general, 6.0 m embankment height has been proposed with flood extent ranging from 500 to 600 m. Other side, embankment arrangements would not mainly require except at RD 16+500 to 17+700 where the people have encroached the river bed.

- The embankment design is proposed with slopes having berm provision to withstand in such areas where soils are sand dominant and settlement are frequent phenomenon. A typical x-section is also provided as guideline having proper treatment of base and stone pitching along with riprap arrangements.
- For cross-drainage structures, it is recommended to retain all such culverts/ drains and structural arrangements should be made to connect/ continue under the Embankment while ensuring no back-water effects.
- In most of the cases, the embankment is to be raised 6.0 m as compared to adjoining areas. Therefore, to ensure drainage from the road itself, drop structures are proposed to be provided at about 50 m apart with proper riprap arrangements to avoid any rill development of the embankment. Therefore, the design guidelines for various components of chute spillway are also provided.

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- (https://www.worldweatheronline.com/thano-shah-beg-weather/sindh/pk.aspx)
- (https://www.worldweatheronline.com/lang/en-in/sari-sing-weather-averages/sindh/pk.aspx

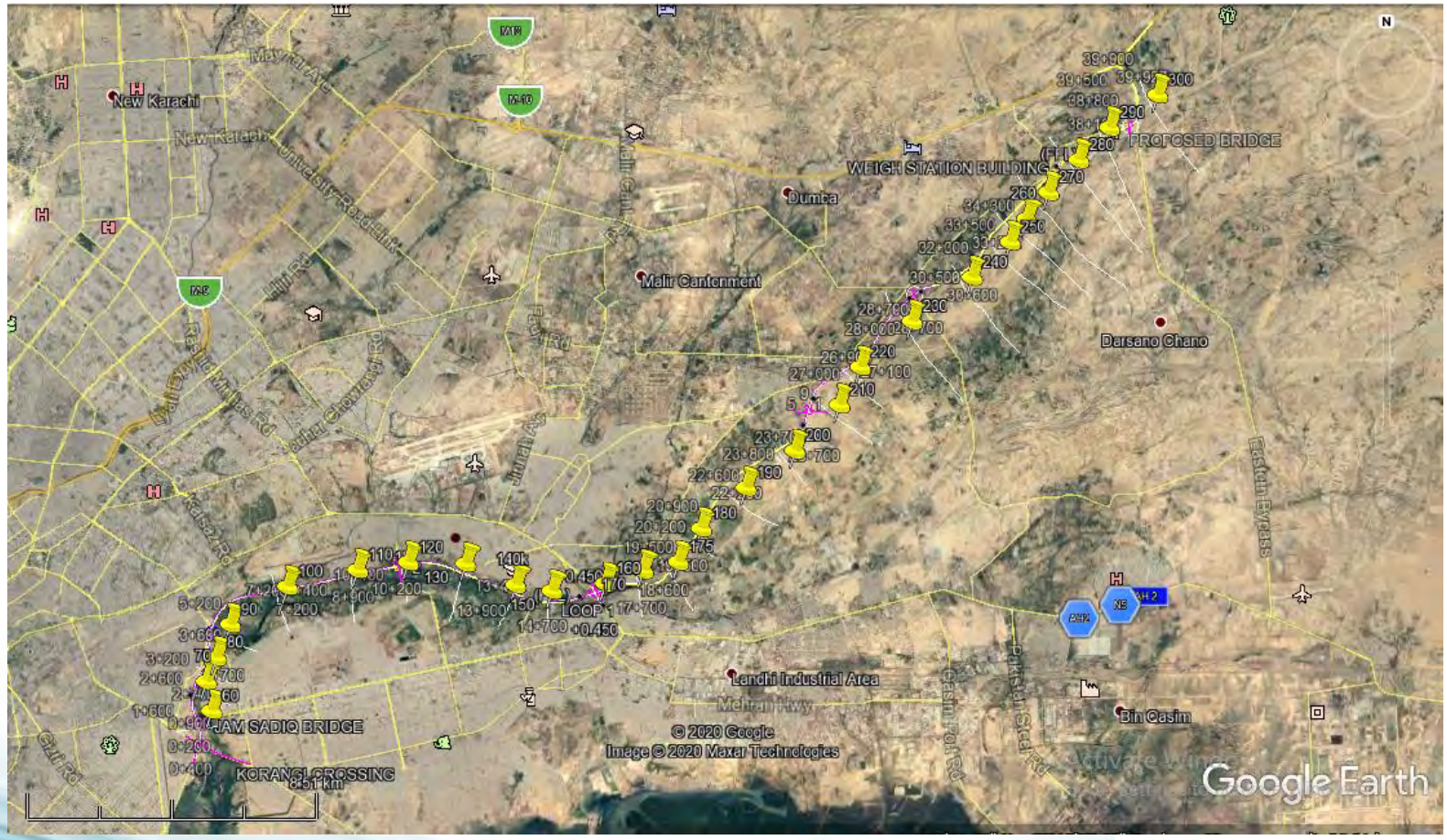
ANNEXURES

Annexure-A: Historical Climatic Data (Karachi Airport)

S.No.	Year	Daily Max rainfall (mm)
1	1967	211
2	1974	6
3	1975	31.6
4	1976	122.4
5	1977	207
6	1978	133.6
7	1979	166
8	1980	43.8
9	1981	47.6
10	1982	74
11	1983	38.9
12	1984	113.7
13	1985	37
14	1986	25.4
15	1987	0
16	1988	51
17	1989	58.8
18	1990	57.2
19	1991	19.5
20	1992	91.7
21	1993	9.8
22	1994	48.7
23	1995	81.3
24	1996	33.2
25	1997	24
26	1998	24.1
27	1999	4.5
28	2000	19
29	2001	52.5
30	2002	47
31	2003	108.4
32	2004	26.3
33	2005	31
34	2006	65.9
35	2007	124.2
36	2008	54
37	2009	142.5
38	2010	77.1
39	2011	75
40	2012	48.7
41	2013	102.6

S.No.	Year	Daily Max rainfall (mm)
42	2014	11
43	2015	28
44	2016	43.4
45	2017	34.8
46	2018	0.01
47	2019	
48	2020	231

Annexure-B: Proposed Options of Alignment



Option 2: Without entering Suman Village

Annex V – Traffic Study Report

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MALIR EXPRESSWAY PROJECT

TRAFFIC STUDY REPORT



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CHAPTER-1

INTRODUCTION

1.1 Background

The Government of Sindh Province is planning to improve the existing road infrastructure of Karachi City and provide more accessibility and mobility to the local commuters. As per the 2017 census, the population of Karachi City is around 16 million out of which 14.9 million live in urban areas. Due to the high growth rate, the demand for residential areas also increased during the last few years. Karachi city is expanding in all directions, especially several housing schemes are already developed or in the pipeline in the north of Karachi. The major housing schemes include Bahria Town, DHA City, and Education City. Moreover, the city government also planned to move the commercial activities in suburban areas such as vegetable market and development of north Karachi Industrial area. The accessibility to these already developed and future planned land uses, is through M-9 or link road between M-9 and N-5. Both highways and internal roads providing access to these are congested and local commuters observed huge delays during peak hours.

1.2 Malir Expressway (MEW)

The Malir Expressway (MEW) will be a six-lane facility (three lanes in each direction) with controlled access. The proposed road will originate from KPT Interchange near Qayyumabad and ends at Karachi – Hyderabad Motorway (M-9) near the Kathore area. The total length of the MEW will be 39 km. MEW will be constructed alongside the Malir River. It will provide the shortest alternative route to M-9 Motorway from the urban areas of Karachi. Moreover, safe, and efficient route to the upcoming residential and commercial projects in the study area. Figure 1.1 shows the MEW alignment and interchanges. Total six (6) interchanges are proposed, located at:

- Jam Sadiq
- EBM Causeway
- Shah Faisal
- Quaidabad (On N-5)
- Interchange 5
- Interchange 6



Figure 1.1 Alignment of Malir Expressway

1.3 Study Methodology

The main purpose of this study is to estimate future travel demand on the MEW. To achieve the objectives, the methodology adopted is shown in figure 1.2.

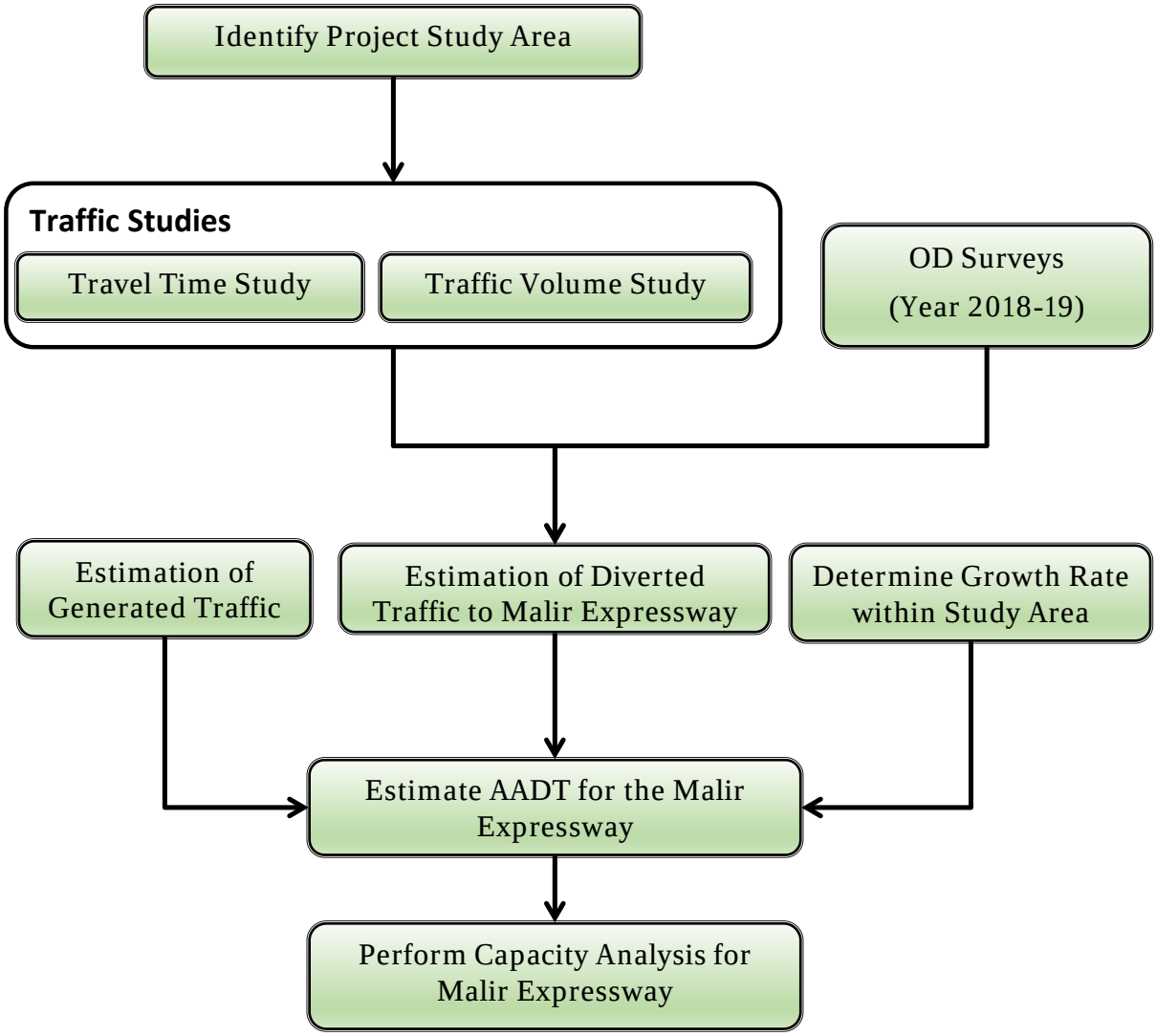


Figure 1.2 Traffic Study Methodology

1.4 Project Study Area

The study area is defined as the area that will be impacted by the proposed road. For this project, the study area mainly consists of Karachi urban area and road network which provide access to Karachi city from other parts of the country. Figure 1.3 shows the road network within the study area. The details about the traffic analysis zones within the study area are provided in the proceeding sections.



Figure 1.3 Study Area and Road Network

CHAPTER-2

TRAFFIC VOLUME STUDY

2.1 Background

The main purpose of the Traffic Volume Study is to determine the existing traffic demand within the study area. The outputs of this study will be used as the input to estimate the future traffic demand on the Malir Expressway (MEW). Most of the information related to existing traffic flow, travel patterns, and driver/vehicle characteristics has been extracted from traffic counts and other on-site surveys performed during the project data collection.

2.2 Type of Traffic Counts

Different types of counts can be done to estimate the existing traffic demand e.g. Turning Movement Counts, Directional Counts. For this project, directional classified counts and Turning Movement Counts both were done to determine the existing traffic demand. The directional counts are performed at selected locations.

2.3 Methodology and Equipment Used

The consultant used a state of the art equipment to perform directional classified counts at all location. Video Recording Units (VCUs) were installed at different locations to record a high definition video recording of traffic. Traffic counts were extracted from the recorded videos using the software. The data were extracted from the recorded videos using software and as well as manually. The extracted data goes through Quality Assurance (QA) and Quality Control (QC) process to make sure the accuracy of data. Figure 2.1 shows the snapshots of VCUs that were used for this project. The units have three days of battery power and can store the video for 72 hours. The equipment is installed on the poles in such a way that all directions should be covered.



Figure 2.1 Video Recording Units used for the Project

2.4 Survey Team

A team of experienced surveyors was formulated before undertaking the field study. The surveyors had good knowledge and experience with data collection. Everyone in the survey team was given standard instructions for the site operation and safety measures to be followed under any circumstances. Special instructions for site selection and setting out of the survey station were provided to the survey team wherever necessary.

2.5 Vehicle Classification

Vehicles were classified according to the Federal Highway Authority (FHWA) vehicle classification scheme. The names and categories were slightly modified according to local Pakistani traffic. Figure 2.2 shows the classification scheme used for this project

with some variation according to local (Pakistan) vehicle classification and axle configuration.

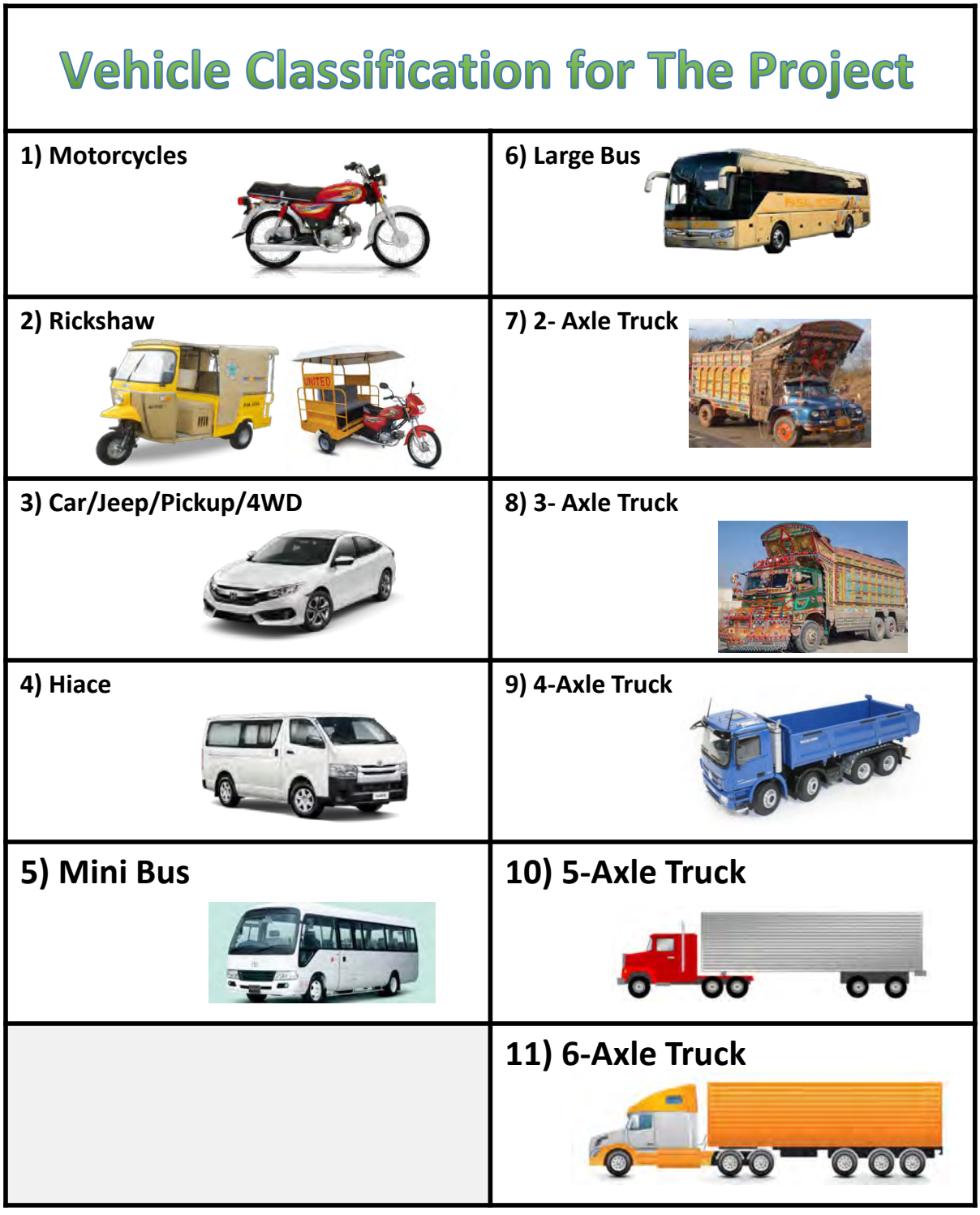


Figure 2.2 Vehicle Classification for the project

2.6 Selected Locations

The consultant carried out 24-hour classified traffic counts at different locations within the study area. The total duration of counts is 3-days (72 hours) for each location as per the guidelines by the National Highway Authority (NHA). A total of eleven (11) locations were selected on all major roads. Figure 2.3 shows the count locations on the aerial map.

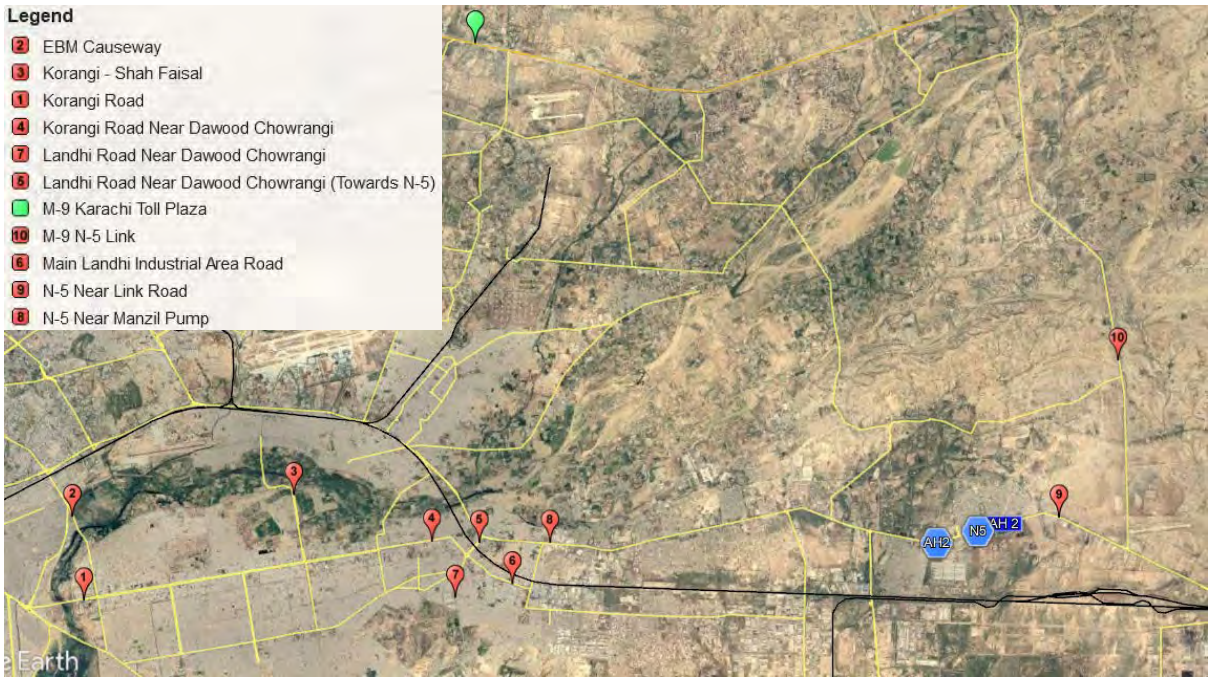


Figure 2.3 Traffic Count Locations

The locations were selected based upon existing traffic demand and roadway network providing access to main developments within the study area. Table 2.1 provides the location ID, name, and schedule of traffic counts at each location.

Table 2.1 Traffic Count Locations ID, Name, and Schedule

Location ID	Road	Description	Duration of Counts
1	Korangi Road	Near Brooks Chowrangi	3 Days (Total 72 hours at each location) Days: Thursday, Friday, Saturday
2	EBM Causeway	Near Brooks Chowrangi	
3	Shah Faisal Korangi Road	Near Singer Chowrangi	
4	Korangi Road	Near Dawood Chowrangi	
5	Landhi Road	Near Dawood Chowrangi, Towards N-5	
6	Main Landhi Industrial Area Road	Near Dawood Chowrangi	
7	Landhi Road	Near Dawood Chowrangi	
8	N5	Near Manzil Pump	
9	N-5	Near Link Road	
10	M9-N5 Link Road	Near Old Toll Plaza	
11	M-9	Karachi Toll Plaza	

2.7 Existing Traffic Demand

The traffic counts were done for three days at each selected location. Table 2.2 shows the classified traffic counts for each direction at eleven (11) locations. The counts showed in the table are an average of three days and represent vehicles per day. The traffic observed on National highway and Motorways locations are mostly intracity traffic whereas, traffic demand on the internal urban road consists of urban commuters.

2.8 Vehicle Composition

The vehicles are divided into four categories: Motorcycles & Rickshaws, Passenger Cars, Public Transport, and Trucks. The public transport consists of Hiace's, Minibus, and Large buses. Figure 2.4 shows the vehicle composition on each road. It should be noted that the percentage of heavy vehicles on the national highways and motorways are significantly higher. Whereas, on internal roads of twin cities, mostly traffic consists of passenger cars and motorcycles.

Table 2.2 Directional traffic counts on the road network with study area (Vehicle per days)

Loc_ID	Locations	Directions	Motorcycle	Rickshaw	Cars	Hiace	Mini Bus	Large Bus	Truck 2-Axle	Truck 3-Axle	Truck 4-Axle	Truck 5-Axle	Truck 6- Axle	Total
1	Korangi Road Near Brooks Chowrangi	Shan Chowrangi to Brooks Chowrangi	11,635	3,610	9,232	1,612	938	287	213	359	586	82	104	**28,658**
		Brooks Chowrangi to Shan Chowrangi	38,804	7,178	19,778	2,776	1,674	600	318	590	965	136	191	**73,010**
		Total (Both Directions)	50,439	10,788	29,010	4,388	2,612	887	531	949	1,551	218	295	**101,668**
2	EBM Causeway	EBM CAUSEWAY TO BROOKS CHOWRANGI	78,450	6,532	17,049	3,091	95	78	587	881	1,468	70	139	**108,440**
		BROOKS CHOWRANGI TO EBM CAUSEWAY	84,853	5,758	18,158	2,264	104	63	541	812	1,353	38	235	**114,179**
		Total (Both Directions)	163,303	12,290	35,207	5,355	199	141	1,128	1,693	2,821	108	374	**222,619**
3	Shah Faisal Korangi Road	SHAH FAISAL TO SINGER CHOWRANGI	109,045	10,714	21,456	3,506	394	380	428	642	1,069	180	283	**148,097**
		SINGER CHOWRANGI TO SHAH FAISAL	124,151	9,061	19,229	3,037	345	96	538	806	1,344	70	164	**158,841**
		Total (Both Directions)	233,196	19,775	40,685	6,543	739	476	966	1,448	2,413	250	447	**306,938**
4	Korangi Road Near Dawood Chowrangi	DAWOOD CHOWRANGI TO KORANGI ROAD	11,994	3,800	8,792	1,791	919	308	434	651	1,085	145	221	**30,140**
		KORANGI ROAD TO DAWOOD CHOWRANGI	35,276	7,324	19,977	3,017	1,800	566	690	1,034	1,723	234	360	**72,001**
		Total (Both Directions)	47,270	11,124	28,769	4,808	2,719	874	1,124	1,685	2,808	379	581	**102,141**
5	Landhi Road Near Dawood Chowrangi (Towards N-5)	DAWOOD CHOWRANGI TO N-5	11,759	2,442	6,659	1,006	600	189	230	345	575	78	120	**24,003**
		N-5 TO DAWOOD CHOWRANGI	15,757	3,708	9,590	1,603	907	291	375	562	936	126	193	**34,048**
		Total (Both Directions)	27,516	6,150	16,249	2,609	1,507	480	605	907	1,511	204	313	**58,051**
6	Main Landhi Industrial Area Road	Dawood Chowrangi to Main Landhi Industrial Area	5,253	1,236	3,197	535	303	97	125	188	312	42	64	**11,352**
		Main Landhi Industrial Area to Dawood Chowrangi	9,172	2,050	5,417	870	502	160	202	303	504	68	104	**19,352**
		Total (Both Directions)	14,425	3,286	8,614	1,405	805	257	327	491	816	110	169	**30,705**
7	Landhi Road Near Dawood Chowrangi	Dawood Chowrangi to Landhi Town	3,058	684	1,806	290	168	54	68	101	168	23	35	**6,455**
		Landhi town to Dawood Chowrangi	4,808	1,096	2,871	468	268	86	109	164	272	37	56	**10,235**
		Total (Both Directions)	7,866	1,780	4,677	758	436	140	177	265	440	60	91	**16,690**
8	N5 Near Manzil Pump	DRIG ROAD TO PORT QASIM	69,846	10,574	33,556	3,679	2,641	772	766	1,148	1,913	267	416	**125,578**
		PORT QASIM TO DRIG ROAD	35,982	11,398	26,375	5,371	2,757	924	1,302	1,953	3,255	434	663	**90,414**
		Total (Both Directions)	105,828	21,972	59,931	9,050	5,398	1,696	2,068	3,101	5,168	701	1,079	**215,992**
9	N-5 Near Link Road	FROM THATTA TO KARACHI	8,535	751	9,751	500	250	315	643	964	1,607	1,112	1,681	**26,109**
		FROM KARACHI TO THATTA	8,427	956	9,660	598	177	247	502	753	1,255	168	259	**23,002**
		Total (Both Directions)	16,962	1,707	19,411	1,098	427	562	1,145	1,717	2,862	1,280	1,940	**49,111**
10	M9-N5 Link Road	N5 TO M9	137	33	732	41	4	162	172	257	428	927	1,391	**4,284**
		M9 TO N5	1,060	63	1,509	19	10	96	106	159	265	1,245	1,871	**6,403**
		Total (Both Directions)	1,197	96	2,241	60	14	258	278	416	693	2,172	3,262	**10,687**
11	M-9 Karachi Toll Plaza	Towards Hyderabad			15,037	750	87	884	1,409	1,468	2,186	480	724	**23,025**
		Towards Karachi			11,608	667	164	942	1,007	1,417	1,851	548	725	**18,929**
		Total (Both Directions)			26,645	1,417	251	1,826	2,416	2,885	4,037	1,028	1,449	**41,954**

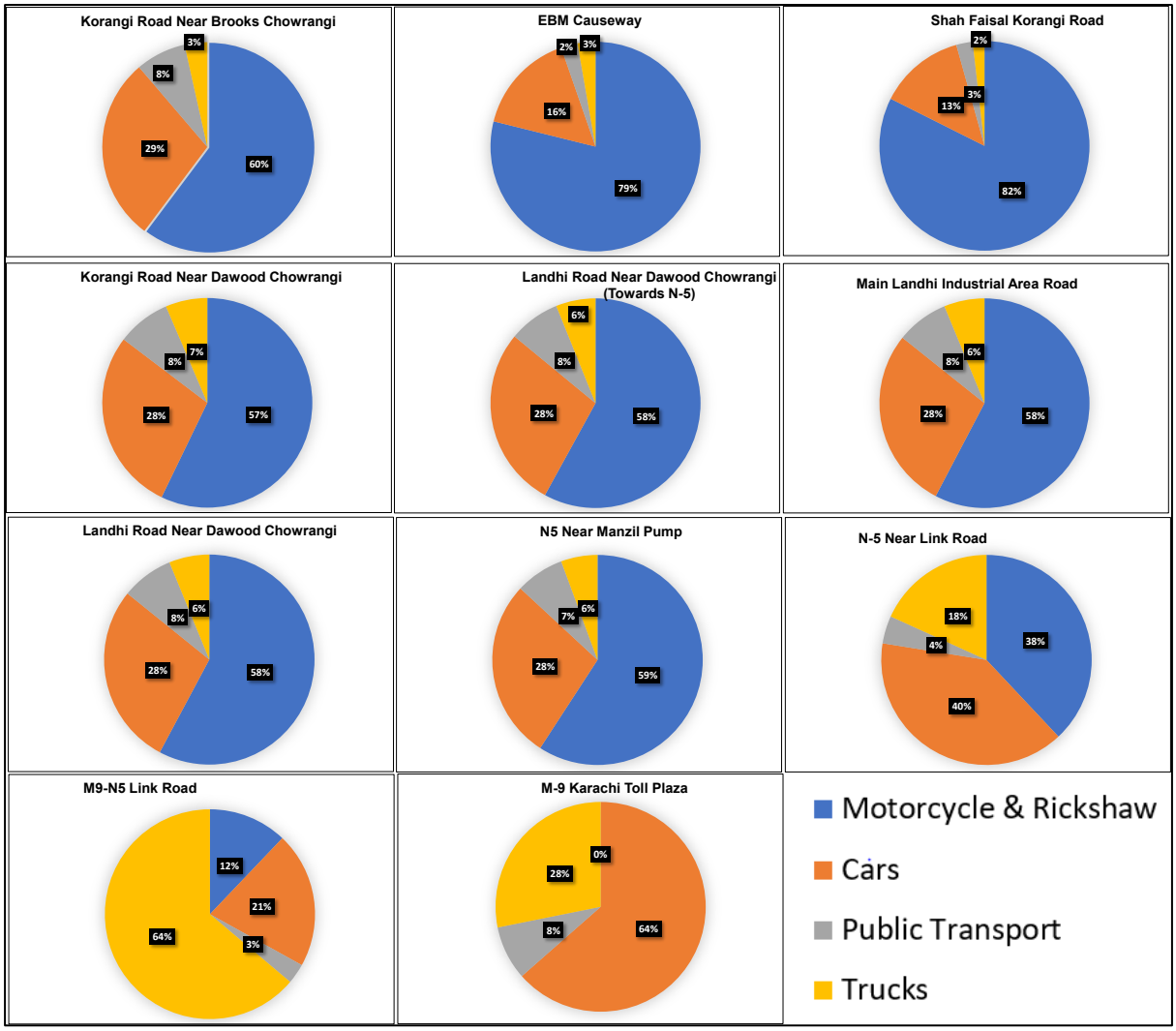


Figure 2.4 Vehicle Composition on the road network within the study area

2.9 Passenger Car Equivalent (PCE)

The term “Passenger Car Equivalent (PCE)” was introduced by Highway Capacity Manual (HCM). According to HCM, PCE is defined as the number of passenger cars displaced in the traffic flow by other transport modes under the prevailing roadway and traffic conditions. PCE factors are used to convert different vehicle classifications in terms of passenger cars. Table 2.3 shows the PCE conversion factor that was taken from the feasibility study of this project Similar, PCE factor was also used for other NHA project.

Table 2.3 PCE factor values

Vehicle Classification	PCE Factor Value
Motorcycles	0.25
Rickshaw	0.5
Car/Jeeps/vans/Taxi	1.00
Minibus/Coaster/HiAce	1.5
Large Buses	2.5
2- Axle Truck	1.5
3- Axle Truck	2.5
4- Axle Truck	3.5
> 5-Axle Truck	4.0

2.10 Determination of Average Annual Daily Traffic

The Average Annual Daily Traffic (AADT) is the average daily traffic on a roadway for all days of the week during one year. The formula to convert daily counts into AADT following formula is used.

$$AADT = (Monthly\ Factor) \times (Average\ Daily\ Count)$$

National Transport Research Centre (NTRC) published “Traffic Factors for Pakistan 3rd edition”. Table 2.4 shows the monthly factors used to convert the average daily traffic into average annual daily traffic.

Table 2.4 Monthly Adjustment Factors (NTRC)

Month	Adjustment Factors
January	1.011
February	1.002
March	1.008
April	0.993
May	0.988
June	0.977
July	1.004

Month	Adjustment Factors
August	1.008
September	1.009
October	1.009
November	0.994
December	1.004

The observed traffic counts on each selected location were converted into AADT in terms of PCE per day using factors provided in Tables 2.3 and 2.4. Figure 2.5 shows the estimated AADT for each location.

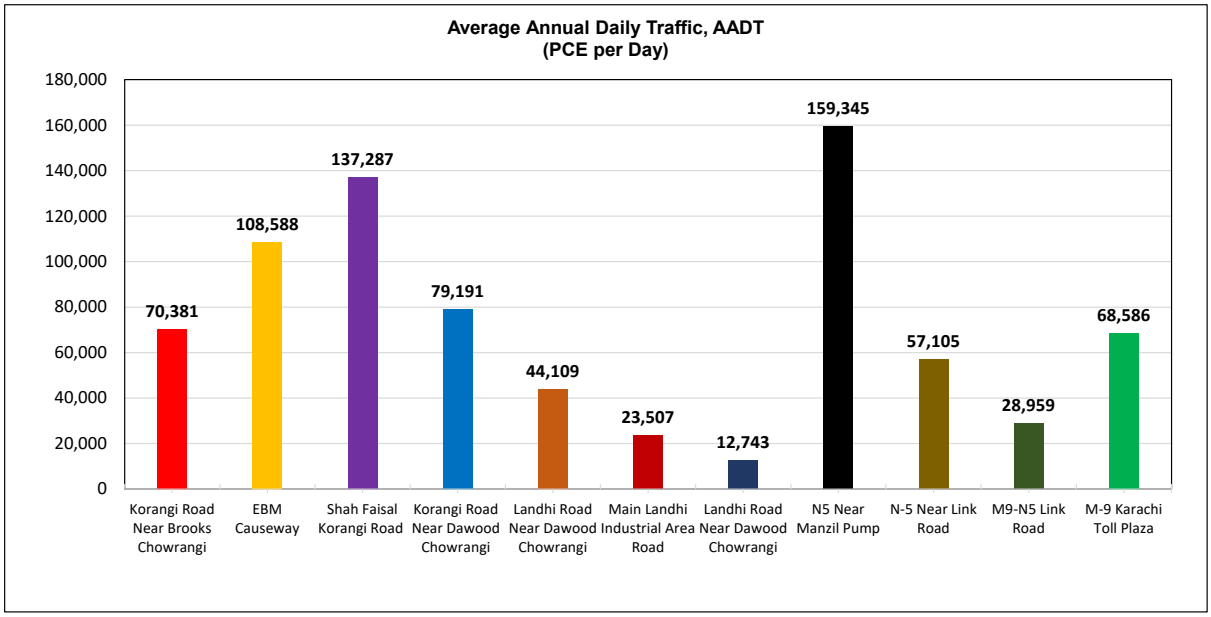


Figure 2.5 Estimated AADT on the road network within the study area

2.11 Estimation of Traffic Growth Factors

Growth factors are used to estimate future traffic demand. There are different growth indicators which include:

- Population
- Registered Number of Vehicles
- Traffic Growth with the study area

2.11.1 Population Growth in Pakistan

The population is one of the main indicators for growth and travel demand in any country. The last two censuses were performed in the year 1998 and 2017. As per the Bureau of Statistics, the population of the country grew from 132.3 million to 207.7 million from the year 1998 to 2017. The annual growth rate of the population in Pakistan is about 2.4%, as shown in table 2.5.

Table 2.5 Population Growth in Pakistan as per the census

Census Year	Population in Millions	Growth Rate in % (Per Year)
1998	132.35	2.4
2017	207.7	

* Source: Pakistan Economic Survey 2017-18

2.11.2 Population Growth in Province of Sindh

The population of the province of Sindh was also reviewed to determine the growth trend. Table 2.6 shows the population of the province of Punjab as per the 1998 and 2017 census. The average growth rate is 2.41 percent.

Table 2.6 Population Growth in Sindh Province as per the census

Census Year	Population in Millions	Growth Rate in % (Per Year)
1998	29.91	2.41
2017	47.89	

* Source: Pakistan Economic Survey 2017-18

2.11.3 Population Growth in the City of Karachi

Karachi is considered the economic hub for Pakistan and works as a backbone in the economic activities of the country. Figure 2.6 shows the urban population of Karachi as per the 1998 and 2017 census. The annual growth rate is about 2.52% for Karachi.

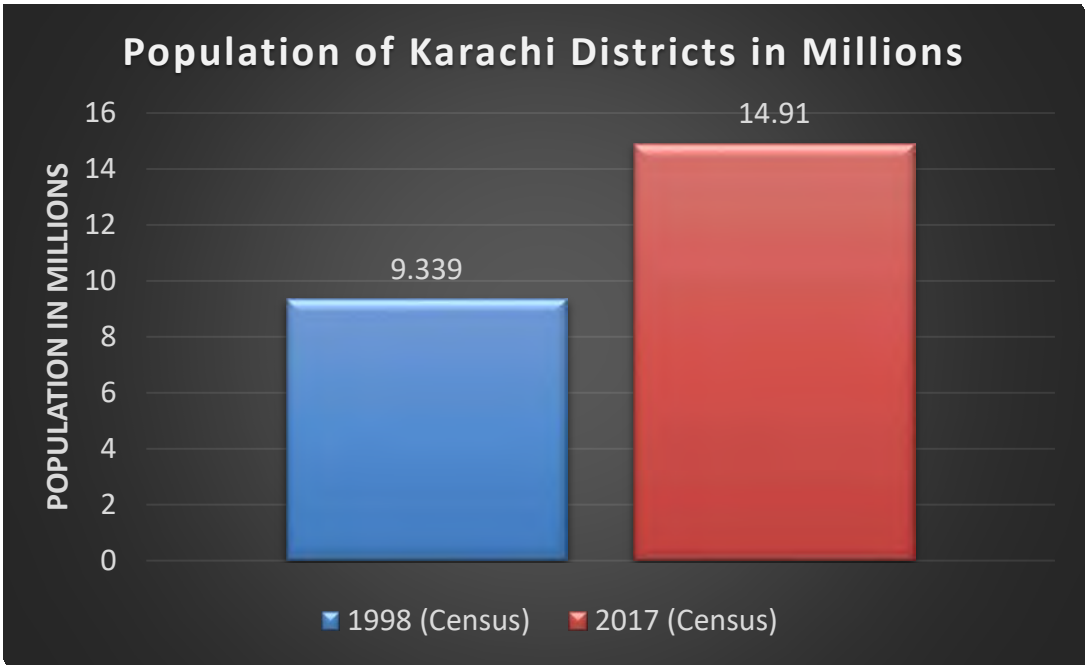


Figure 2.6 Population within the study Area

2.11.4 Growth of Registered Vehicles in Pakistan

Table 2.7 shows the number of registered vehicles in Pakistan during the last five years. The average growth of 6.1, 1.5, and 2.5 percent were observed for Cars, Buses, and Trucks, respectively.

Table 2.7 Number of Vehicles on Road in Pakistan from 2013 to 2017

Year	Motor Cars	Buses	Trucks
2013	2,281,083	220,347	247,197
2014	2,437,735	224,403	253,574
2015	2,580,922	228,959	262,288
2016	2,776,588	232,181	266,763
2017	2,889,500	233,884	272,934
Average Yearly Growth in %	6.1	1.5	2.5

* Source: Pakistan Economic Survey 2019

2.11.5 Fuel Consumption in Pakistan

The other good indicator for the estimate the traffic growth is the fuel consumption during the last five years. Table 2.8 shows the fuel consumption since the year 2009. The average growth rate is 6.43 %.

Table 2.8 Fuel Consumption in Pakistan from 2009 to 2017

YEARS	Fuel Consumption (Tons)	Growth Rate (%)
2009-2010	8,860,880	6.43
2010-2011	8,892,268	
2011-2012	9,265,883	
2012-2013	9,817,546	
2013-2014	10,299,718	
2014-2015	11,372,924	
2015-2016	13,022,573	
2016-2017	14,582,925	

2.11.6 GDP Growth in Pakistan

Mostly, the freight movement and truck traffic depends upon the Gross Domestic Production (GDP) growth. Table 2.9 shows the GDP growth from the year 2009.

Table 2.9 GDP Growth in Pakistan

GROSS DOMESTIC PRODUCT(Fc)		
YEARS	Rs. Million	Growth Rate (%)
2009-2010	8,801,394	3.62
2010-2011	9,120,336	
2011-2012	9,470,255	
2012-2013	9,819,055	
2013-2014	10,217,056	
2014-2015	10,631,649	
2015-2016	11,116,802	
2016-2017	11,696,934	

2.12 Adopted Growth Rates

Different indicators were reviewed for the estimation of growth factors for the travel demand forecasting. The number of registered cars in Pakistan increased at a rate of 6.1%. Most importantly, the urban population of Karachi increased at a rate of 2.52 %.

Based on the growth rate of different parameters, the growth rate was estimated for this project shown in Table 2.10. The growth rate for Cars and Public Transport is the geometric average of registered vehicles, fuel consumption, and population, whereas for trucks the GDP factor is added. Different growth rates were adopted for cars, buses, and trucks, as per the trend observed in the historical growth of these vehicle classes.

Table 2.10 Estimated Growth Rates for the study area

S. No	Vehicle Type	Growth Rate 2022 - 2027	Growth Rate 2027 - 2037
1	**Passenger Cars**	6.5	5.5
2	**Hiace/Minibus**	5.0	4.0
3	**Large Buses**	5.0	4.0
4	**2 – Axle Rigid Truck**	4.0	3.5
5	**3 – Axle Rigid Truck**	4.0	3.5
6	**4 – Axle Articulated Truck**	4.0	3.5
7	**5 – Axle Articulated Truck**	4.0	3.5
8	**6 – Axle Articulated Truck**	4.0	3.5

Chapter 3

ORIGIN AND DESTINATION STUDY

3.1 Introduction

O-D surveys were conducted to ascertain the road user information and necessary data collection in the study area. The O-D Surveys provide data regarding the origin and destination of each vehicle type traveling along the studied corridor. The O-D survey information has been collected as sample surveys for passenger vehicles and freight vehicles over periods of 72 hours at seven locations. The O-D surveys were conducted at the same locations where traffic counts were done (Shown in table 2.1). It should be noted that the OD Surveys were conducted in the Year 2018/2019. The travel behavior and pattern do not change over a short interval of time, therefore the OD data collected during the year 2018-19 will be used to develop the OD matrices

3.2 O-D Survey Methodology

3.2.1 Zoning

The study area was divided into 14 Traffic Analysis Zones, based on the proposed Malir Expressway alignment and its impact on the traffic operations on the existing roadway network. The area and size of the zones were kept small near the proposed alignment whereas for other locations different parts of cities were combined in the same zone. Figure 3.1 shows the locations, ID, and towns included in each zone. The O-D survey was conducted for three days (72 hours) at each location.

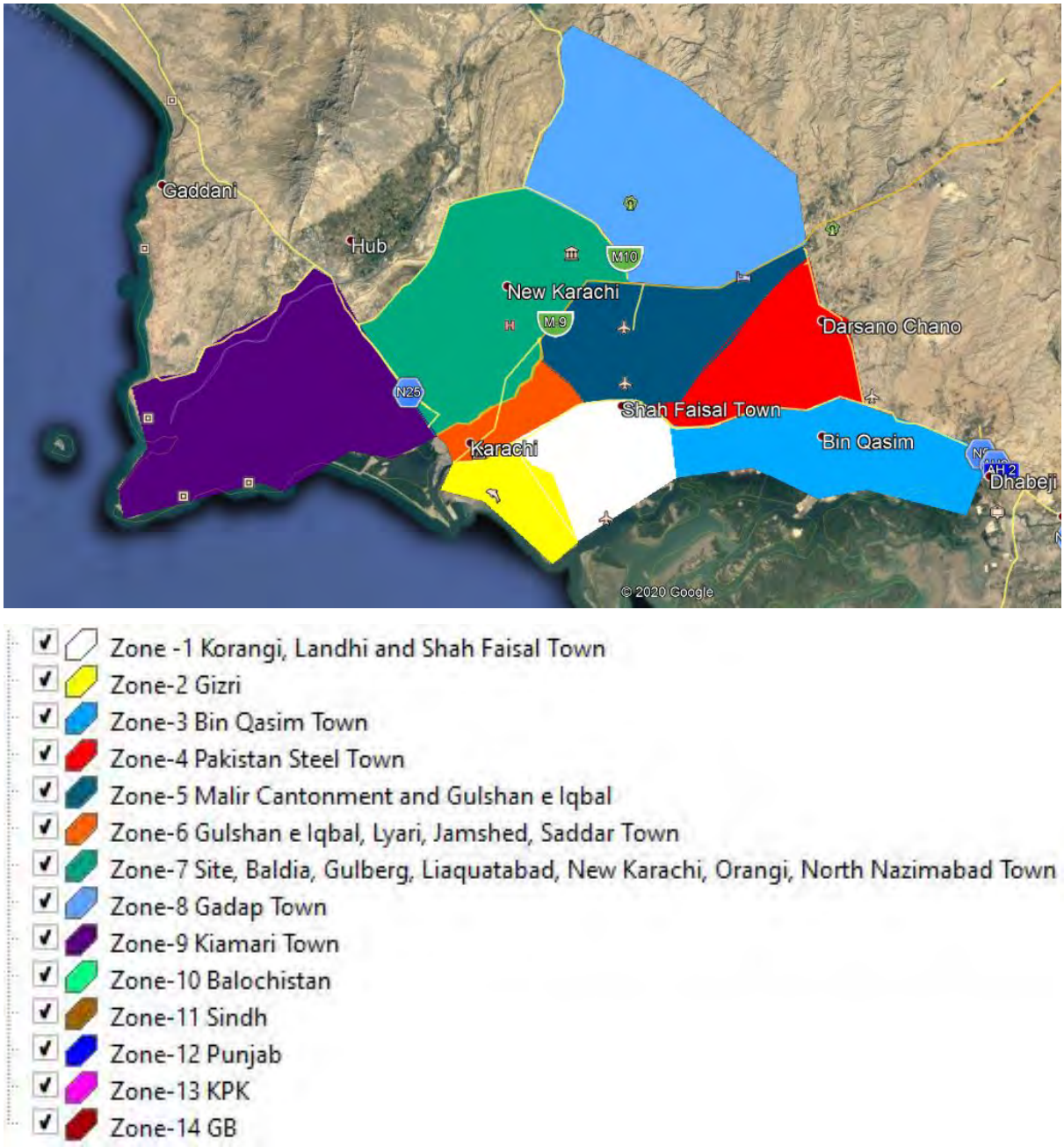


Figure 3.1 Traffic Analysis Zones for the Project

3.2.2 Survey Questionnaire

The first task before conducting the survey was to develop the questionnaire to be asked from the drivers. The main objective of these surveys was to find the origin and destination of the commuters. Other than O-D info, questions were added to the questionnaire related to trip purpose. Figure 3.2 shows the snapshot of the survey questionnaire form used. The survey questionnaire also consists of information about the vehicle type.

Malir Expressway Project Origin Destination Survey

Time Period: _____

Date: _____

Location: _____

ZEERUK INTERNATIONAL Pvt. Ltd

Serial Number	Vehicle Type	Trip Origin	Trip Destination	Trip Purpose
1				
2				
3				
4				
5				
6				
7				

Figure 3.2 OD Survey form for Roadside Interviews

3.2.3 Field Team for O-D Survey

The O-D Survey was conducted in November 2020. The survey team consists of a total of 14 members. Proper training was given to the survey team related to the Methodology to conduct the survey, Field Safety, and Filling of the questionnaire. The team members were also brief about the Malir Expressway Project and its proposed alignment. This helps them to understand the purpose of the survey and answer any questions related to the project asked by the interviewee.

To conduct the O-D Survey smoothly & safely, help was requested from the local police authorities. Two police persons were appointed at each location, one for each direction. The traffic police persons stopped the vehicle for the interview, the surveyor first informs the driver about the project and then asked the questions to fill the questionnaire. The interview took approximately 2 to 3 minutes and after completion of each survey next arriving vehicle was stopped and requested for the interview. Figure 3.3 shows the OD Survey Team near to M-9 Toll Plaza



Figure 3.3 OD Survey Team

3.3 Survey Sample Size

All efforts were made to include the maximum number of vehicles and all class of vehicles in the interview and data collection. The police presence helps to stop the vehicle for the interview. The sampling was done randomly, by stopping any upcoming vehicle after the completion of the survey. Sample sizes range from 10 to 15 percent of traffic passed through during the O-D data collection time period.

3.4 O-D Matrices

As discussed earlier, the study area is divided into 14 traffic analysis zones. The O-D Matrix was developed for each location. The raw data obtained from the filled O-D forms were first digitized and then converted into a 24 hour estimated O-D Survey based upon the location traffic count and survey sample size. The O-D data for all locations were combined to obtain the final OD matrix for the study area. The O-D analysis is done for three vehicle categories separately i.e. Passenger Cars (Private Transport), Public Transport (HiAce's, Buses), and Trucks. Tables 3.1. 3.2, and 3.3

show the final study area O-D matrix for passenger cars, public transport, and heavy vehicles, respectively. The O-D matrix will be used in the Travel Demand Forecasting to estimate the future traffic demand on the proposed Malir Expressway.

Table 3.1 Final O-D Matrix, Passenger Cars per Day

Passenger Cars														
Destination / Origin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1	363	14	49	74	189	91	181	2	0	0	17	18	20	15
2	32	1	14	0	26	19	18	0	0	44	51	13	0	0
3	43	107	5	3	103	47	54	1	0	24	318	5	14	11
4	69	4	9	7	57	11	16	3	2	0	1	6	0	0
5	146	7	68	54	108	11	38	1	0	8	57	20	1	0
6	91	10	20	15	37	8	11	6	0	24	233	16	0	0
7	110	4	17	9	30	6	8	2	0	1	29	17	0	0
8	2	0	2	1	3	1	4	0	0	0	17	0	0	0
9	2	2	2	0	0	0	0	0	0	0	0	0	0	0
10	2	5	1	0	0	0	0	0	0	8	10	3	0	0
11	0	0	0	0	0	0	0	0	0	0	3	0	0	0
12	60	18	10	0	28	39	77	0	0	4	90	2	0	0
13	6	6	4	0	5	2	9	0	0	0	34	1	0	0
14	0	0	0	0	5	3	0	0	0	8	12	0	0	0

Table 3.2 Final O-D Matrix, Public Transport per Day

Public Transport														
Destination / Origin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1	78	10	27	18	63	34	56	10	10	0	0	12	10	5
2	18	0	2	0	21	1	3	0	0	0	1	5	2	1
3	23	7	3	2	9	1	22	0	0	0	4	4	0	0
4	69	8	6	2	12	15	9	1	4	0	0	0	0	0
5	182	11	16	23	18	16	35	0	0	0	36	8	5	4
6	37	0	1	2	19	2	6	0	0	0	21	16	11	5
7	26	2	1	1	2	9	16	0	8	0	0	5	1	2
8	0	0	0	0	0	4	2	0	0	0	2	0	0	0
9	0	0	0	0	2	1	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	1	1	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	6	0	1	0	1	22	12	0	0	0	6	0	0	0
13	0	0	0	0	0	1	0	0	0	0	3	0	0	0
14	0	0	0	0	0	0	1	0	0	0	5	0	0	0

Table 3.3 Final O-D Matrix, Heavy Vehicles per Day

Heavy Vehicles														
Origin \ Destination	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1	73	3	42	20	36	11	36	0	0	4	5	19	27	21
2	30	100	33	1	49	28	72	0	0	88	431	680	5	2
3	11	21	11	1	21	22	58	1	0	0	38	19	57	32
4	9	0	2	1	9	3	16	0	0	0	0	0	1	0
5	31	12	40	8	25	6	28	0	0	24	46	26	1	1
6	10	8	38	2	39	9	31	0	0	4	197	22	6	5
7	21	2	15	7	7	1	13	0	0	0	7	4	1	0
8	0	1	0	0	1	0	5	0	0	0	7	2	0	0
9	5	0	0	0	0	0	1	0	0	0	0	0	0	0
10	2	8	11	0	6	0	0	0	0	16	20	46	5	0
11	0	1	0	0	0	0	0	0	0	0	1	0	1	0
12	24	37	10	0	40	38	83	0	0	4	81	30	1	0
13	24	31	38	0	16	40	98	0	0	40	85	39	6	0
14	0	3	0	0	2	2	3	0	0	0	9	1	4	0

CHAPTER-4

TRAVEL TIME STUDY

4.1 Overview

A travel time study is used to determine the travel time and average speed of vehicles on the existing corridor with prevailing conditions. The Travel Time Surveys were carried out by the Zeeruk team to ensure that the team had a good understanding of the network operation in the study area. Actual travel time runs were conducted.

4.2 Methodology

Travel time data was collected using a vehicle-mounted transmission sensor and a GPS receiver/laptop computer/GPS software combination. Figure 4.1 illustrates the frameworks and equipment used for GPS travel Time data collection in this project. The software records the location (Latitude and Longitude), speed, number of nodes, and distance traveled with the interval of one second. The collected data from the travel time runs were compiled using the computer software program PC-TRAVEL. Data transferred to PC-TRAVEL was used to generate different types of reports. The main output of the software consists of Travel Time, Travel Distance, Average Speed, fuel consumption, vehicle speed profile, and Time Space Diagram.

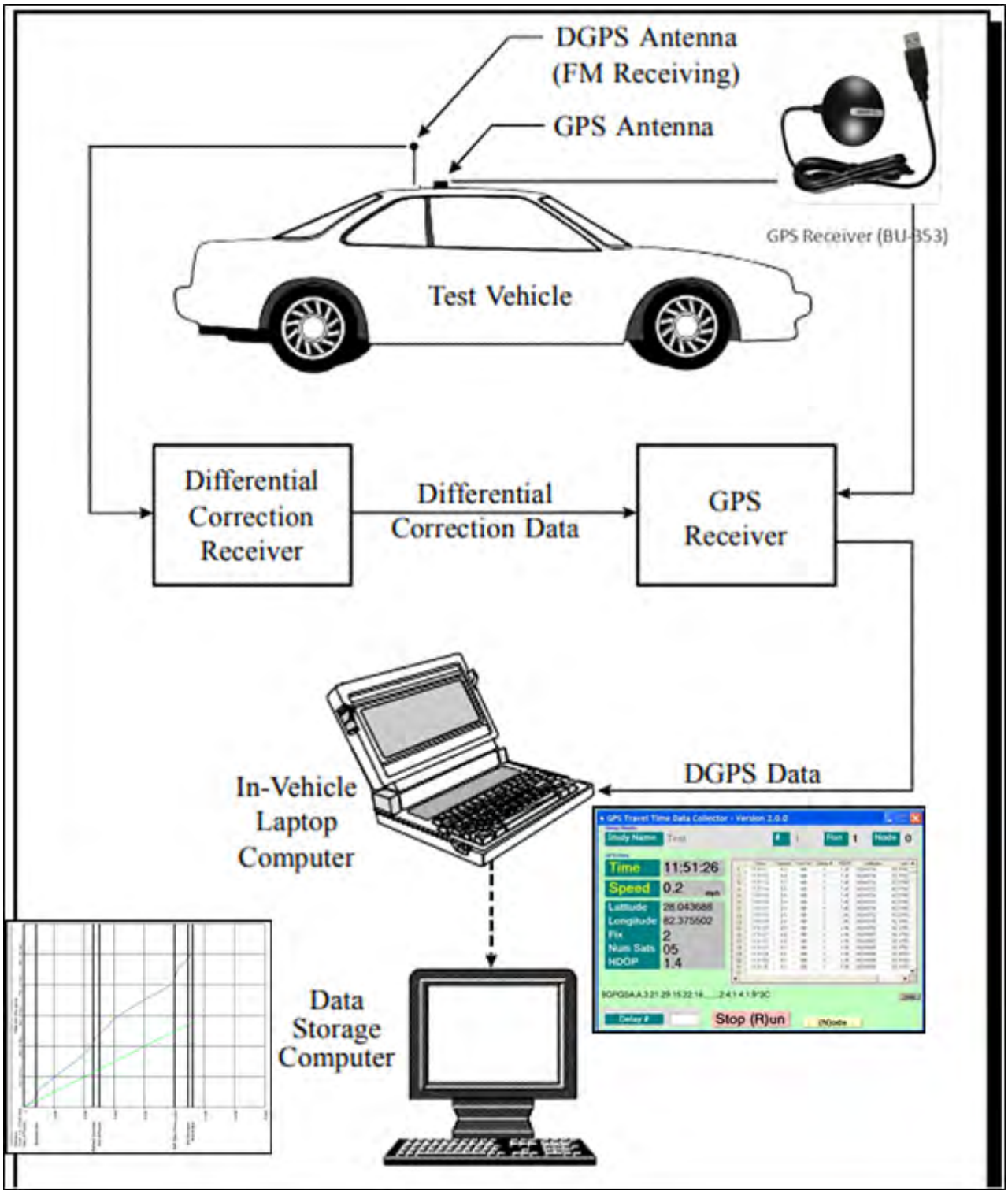


Figure 4.1 Travel Time study data collection equipment and GPS software

4.3 Entry Routes to Karachi City

As discussed earlier, Karachi is Pakistan's largest city and principal seaport. It is a major commercial and industrial center of a country. Other than local commuters, major freight traffic comes to Karachi from other cities. There are major three entry/exit routes for Karachi. Figure 4.2 shows the entry/exit routes for the city of Karachi.

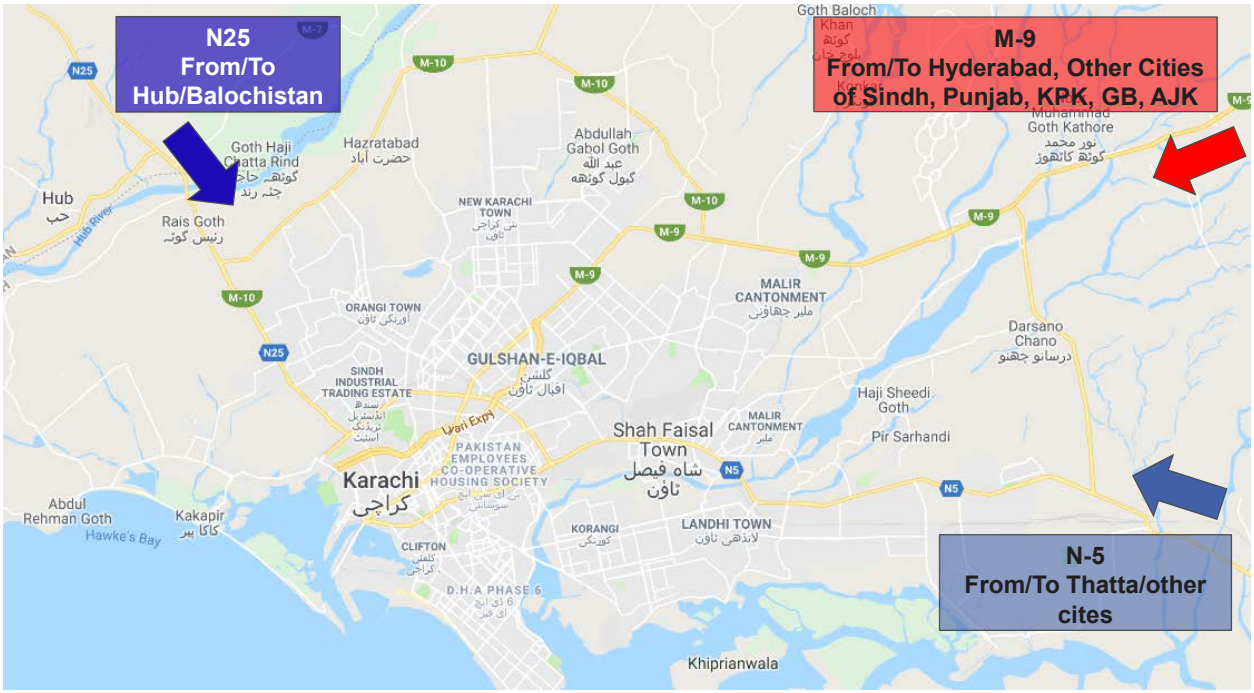


Figure 4.2 Entry/Exit Routes for City of Karachi

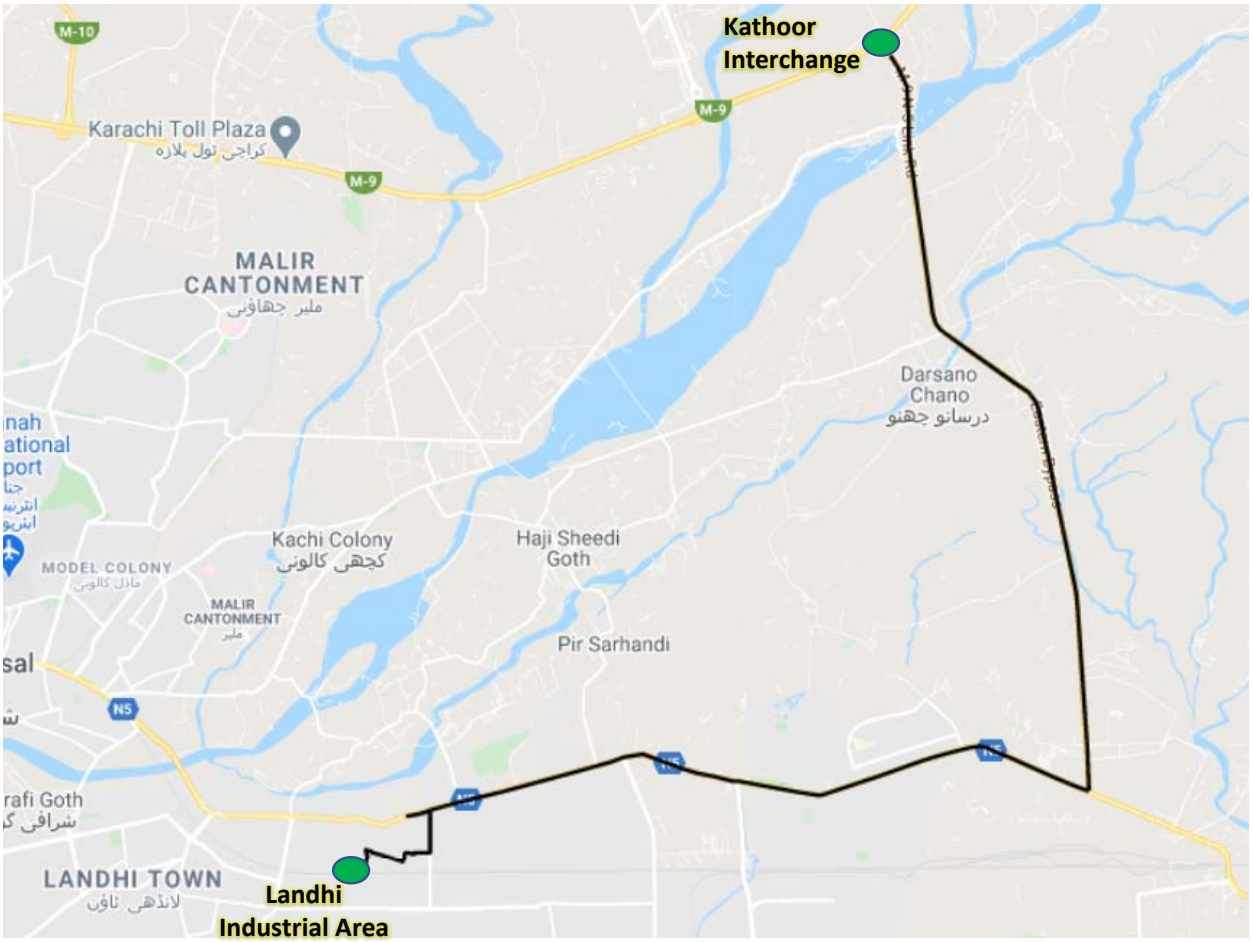
4.4 Estimation of Existing Travel Time

Travel Time is one of the measures of effectiveness (MOE) to evaluate the existing road network. This output of travel time study is also used as input in Travel Demand Forecasting. The existing major routes and roads in the vicinity of the Malir Expressway are illustrated in the following sections.

4.4.1 Landhi Industrial Area to Kathoor Interchange (M-9)

The Landhi Industrial Area attracts major truck traffic. The Landhi town has a densely populated area and generates significant traffic as the daily commuters. To evaluate the

traffic flow condition, a travel time study was done from the Landhi area to Kathoor Interchange on M-9 using M-9 N-5 Link Road, as shown in Figure 4.3. It should be noted that actual travel time runs are done using passenger cars, for the truck it is estimated based upon the truck average speed.

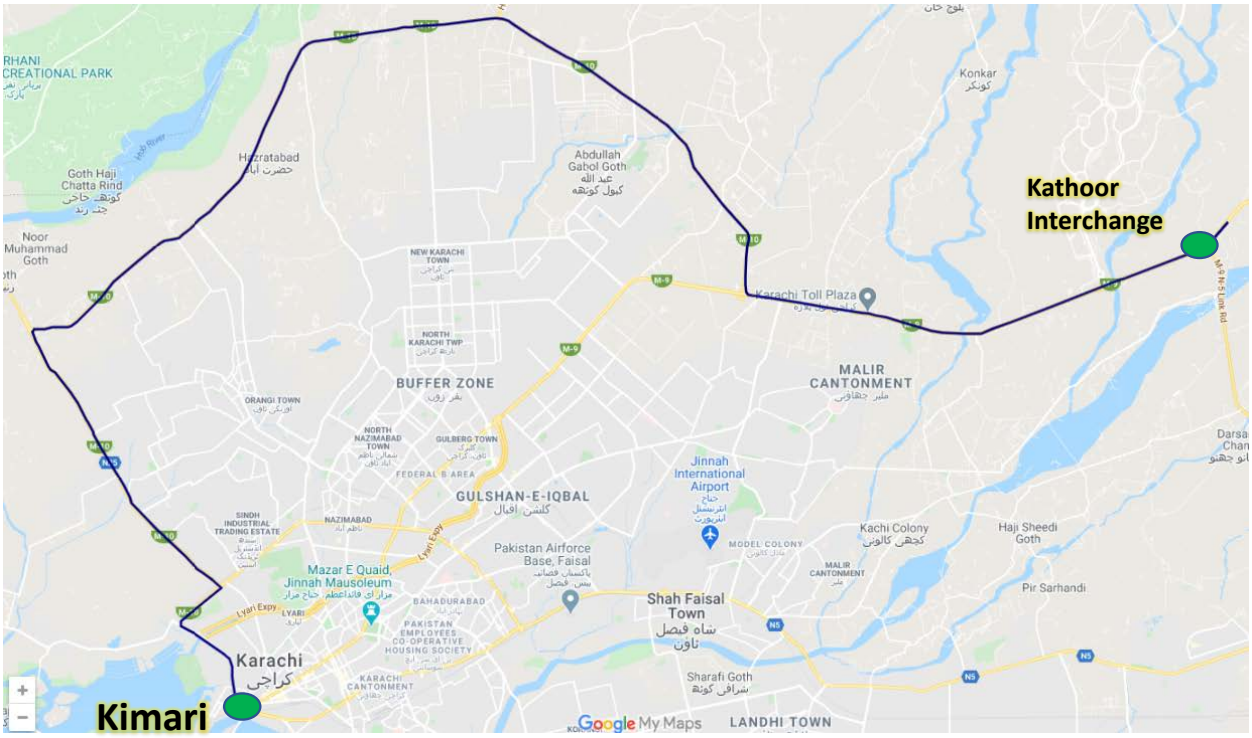


Origin	Destination	Vehicle	Route	Travel Distance (Km)	Travel Time (hrs)
Landhi Industrial Area	Kathoor Interchange	Truck	N-5→M-9 N-5 Link Road (Eastern Bypass)→ M-9	40 Km	1.7
		Car			0.8

Figure 4.3 Landhi to Kathoor Interchange @ M-9

4.4.2 Kimari to Kathoor Interchange (M-9)

The trucks are not allowed to enter on local roads of Karachi during the daytime. The only route which is open 24 hours, is the Northerbypass route. Although, it is long and takes too much time still major truck traffic is using this route who want to access the kemari/KPT area. Figure 4.4 shows the travel time study results from Kimari to Kathoor Interchange at M-9. Due to poor road conditions especially on M-10 (Northernbypass) and traffic congestion during the peak hours, major delays are observed.



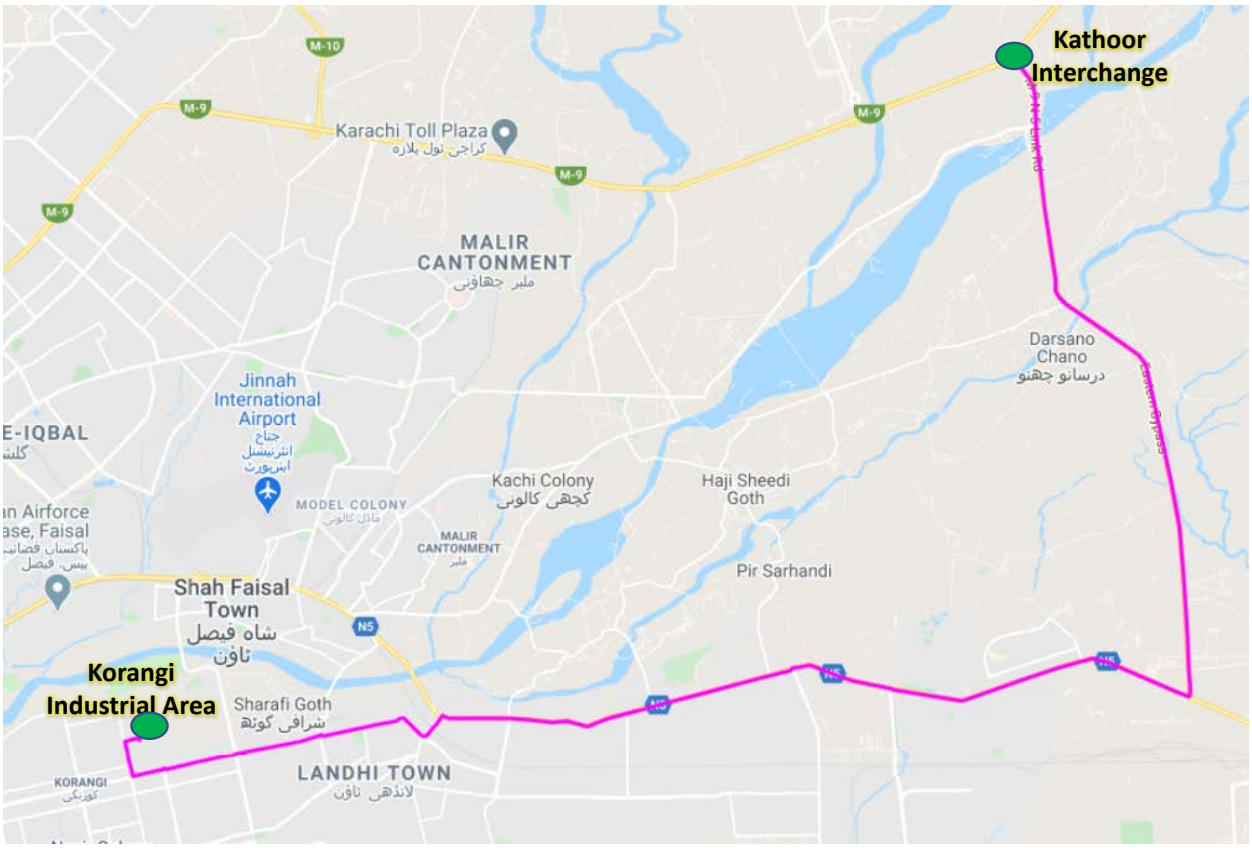
Origin	Destination	Vehicle	Route	Travel Distance (Km)	Travel Time (hrs)
Kimari	Kathoor Interchange	Truck	Kimari → N-25→M-10 (Northern Bypass)→ M-9	77 Km	2.5

Figure 4.4 Kimari to Kathoor Interchange @ M-9

4.4.3 Korangi Industrial Area to Kathoor Interchange (M-9)

The Korangi industrial area is one of the major traffic generators in the study area of Malir Expressway. It generates and attracts a huge number of trucks. A large number of local

commuters daily travel to Korangi Industrial area for work. Figure 4.5 shows the route and travel time study results from Korangi Industrial area to Kathoor Interchange at M-9. The commuters used M-9 N-5 Link Road (Eastern Bypass) to access M-9.

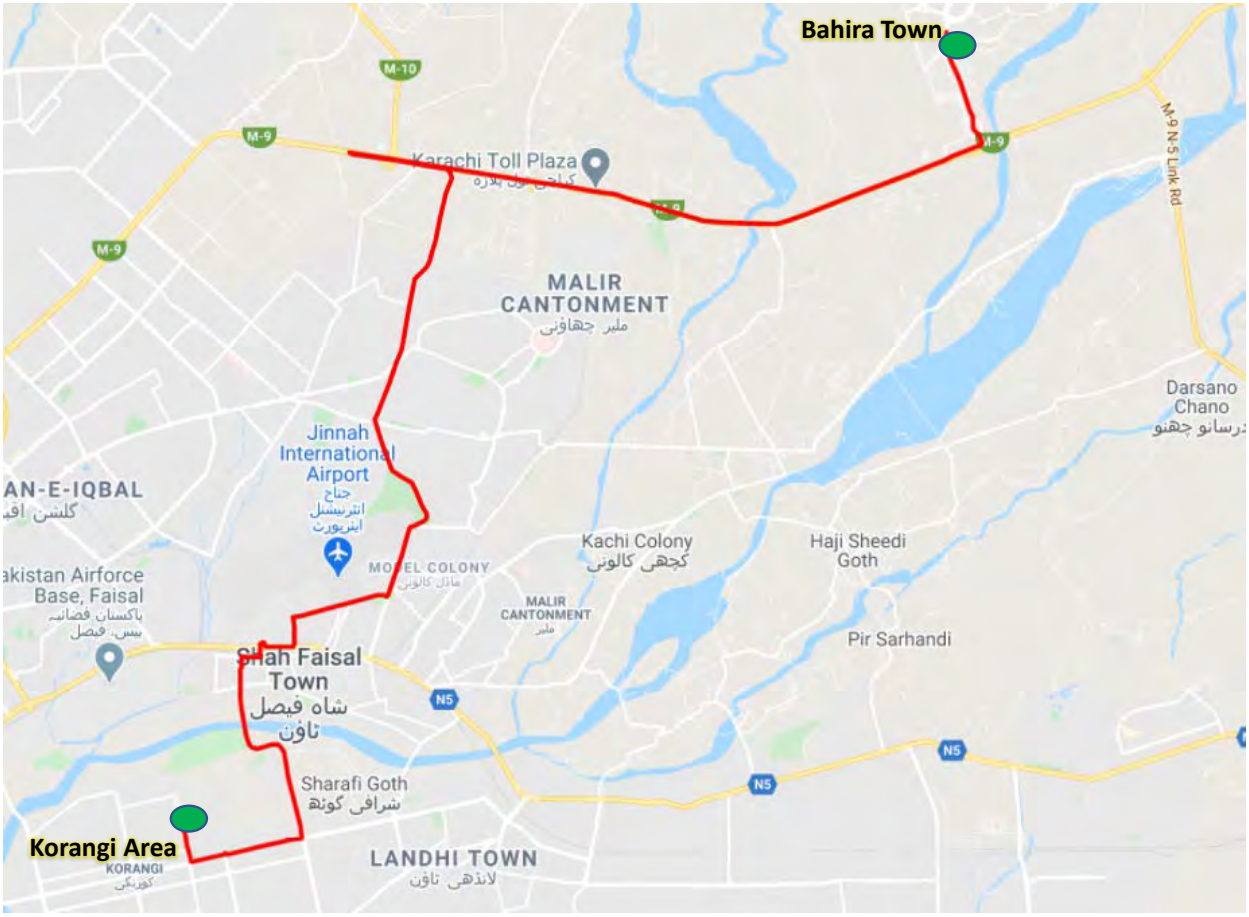


Origin	Destination	Vehicle	Route	Travel Distance (Km)	Travel Time (hrs)
Korangi Industrial Area	Kathoor Interchange	Truck	Korangi Road→N-5→M-9 N-5 Link Road (Eastern Bypass)→ M-9	48 Km	1.92
		Car			1.06

Figure 4.5 Korangi Industrial Area to Kathoor Interchange @ M-9

4.4.4 Korangi Area to Bahira Town

The Bahira town Karachi is a newly developed residential area that also has major commercial and recreational land use. Due to modern housing, facilities and safety, Bahria Town Karachi is very popular among locals and overseas Pakistani. The people already living in Bahira Town and it to expected that in coming years it will be fully occupied. The Malir Expressway will provide safe and efficient access to Bahir Town and the upcoming DHA City. Figure 4.6 shows the existing route used by daily commuters to/from Bahria Town to/from Korangi Area.

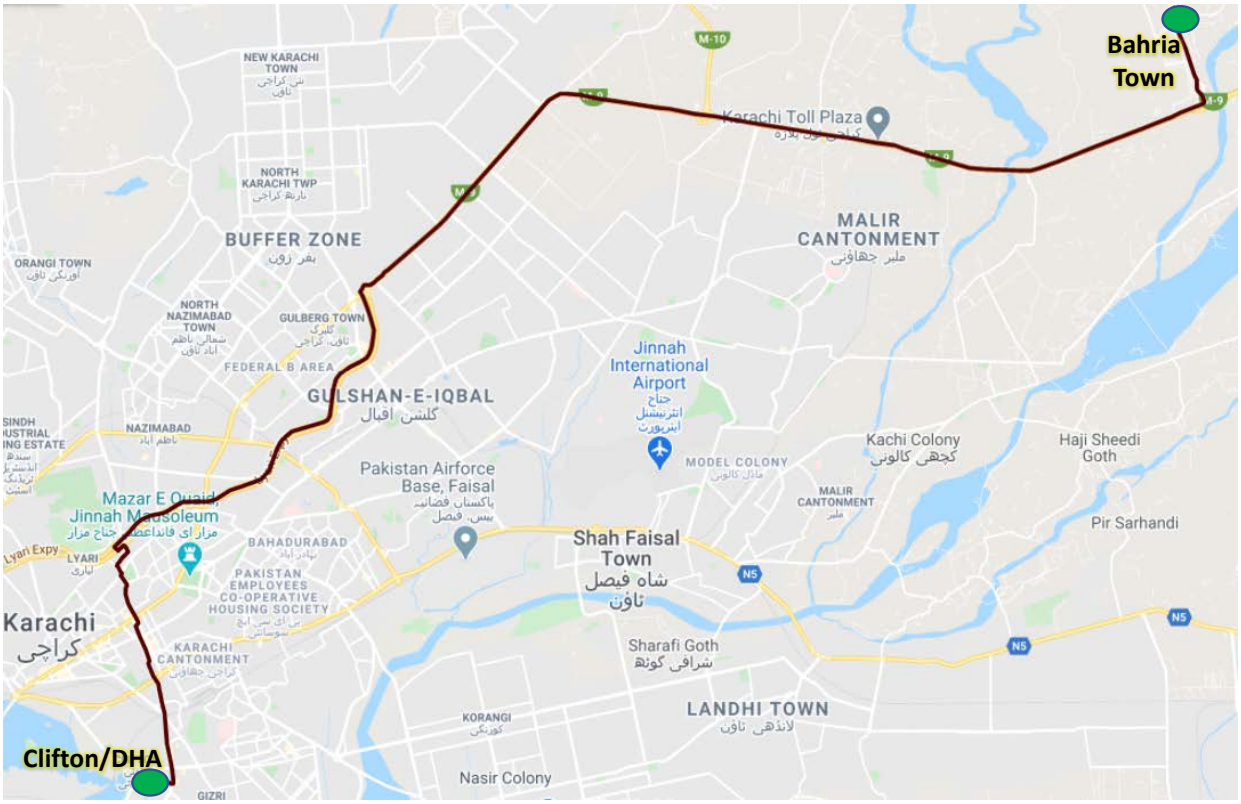


Origin	Destination	Vehicle	Route	Travel Distance (Km)	Travel Time (hrs)
Korangi Area	Bahira Town	Car	Korangi Road→Korangi Shah Faisal Road→Shahrah –e-Faisal → Airport Road→ Malir Link Road → M-9	47 Km	1.15

Figure 4.6 Korangi Area to Bahria Town Karachi

4.4.5 Clifton/DHA to Bahria Town

The Clifton and DHA areas in Karachi have major residential and commercial land use. The daily commuters going and coming from Bahria town to Clifton or DHA will be a potential user of Malir Expressway. The travel time study was done to estimate the existing travel pattern and route used by the daily commuters. Figure 4.7 shows the travel time study results for commuters traveling from Clifton/DHA to Bahria Town. To travel approximately 57 km it took daily commuters more than one hour 20 minutes



Origin	Destination	Vehicle	Route	Travel Distance (Km)	Travel Time (hrs)
Clifton/DHA	Bahira Town	Car	Abdullah Haroon Road Road→Lyari Expressway→M-9	57 Km	1.20

Figure 4.7 Clifton/DHA to Bahria Town Karachi

4.5 Summary

Travel time studies are used to evaluate existing traffic conditions such as the onset of congestion along major routes. It provides the necessary data to determine the average travel time and speed and aids as a tool for planning of proposed infrastructure development project. The trips which have the potential to divert to Malir Expressway are evaluated. Due to huge traffic congestion and poor road condition, major delays on each route were observed.

CHAPTER-5

TRAVEL DEMAND FORECAST

5.1 Introduction

The travel forecasting phase of the transportation planning process is to perform a conditional prediction of travel demand on the transportation facility in the future. The process of Travel Demand Forecasting consists of four steps: Trip Generation, Trip Distribution, Modal Split, and Traffic Assignment. The information about the zone related to socio-economic factors such as employment, population, household size, origin, and destination of each zone is used to estimate the trip generation of each zone. Moreover, Trip Distribution was estimated based upon the O-D data analysis. Modal Split was estimated using the vehicle distribution estimated through the traffic volume surveys. The travel demand estimation can be done using transport modeling software and the diversion curve method. The software VISUM is one of the popular software used for future travel demand estimation. However, it requires comprehensive data such as social-economic characteristics of each zone, car ownership information, public transport usage, and other information related to the daily commute. To estimate the traffic demand on Malir Expressway, it is vital to review the upcoming major projects within the study area.

5.2 Upcoming Planned Projects in the Study Area

It is important to review the planned projects within the study area, which can impact the traffic demand on Malir Expressway.

5.2.1 Road Projects

There are two major projects identified which are already approved, which are:

- **Realignment and Improvement of M9-N-5 Link Road Project**. This project will impact significantly Malir Expressway Traffic Demand. Figure 5.1 shows the proposed new alignment of M-9 N-5 Link Road which is also known as Eastern Bypass. This new alignment will provide an efficient route for the traffic accessing M-9, specially generated from Steel mills and Port Qasim.



Figure 5.1 Realignment of M-9 N-5 Link Road

- **Lyari Elevated Freight Corridor**: National Highway Authority (NHA) is performing a feasibility study and detailed design of Lyari Elevated Freight Corridor. This freight corridor will provide the shortest direct link from KPT to M-9.

5.2.2 Other Planned Land Use within Study Area

The Government of Sindh had approved the number of residential, commercial, and Institutional projects within the study area. The major one includes Bahria Town, DHA City, and Education City. These planned projects will attract a significant number of daily commuters and accessibility to these land uses will improve with Malir Expressway. Figure 5.2 shows the major planned projects within the study area.

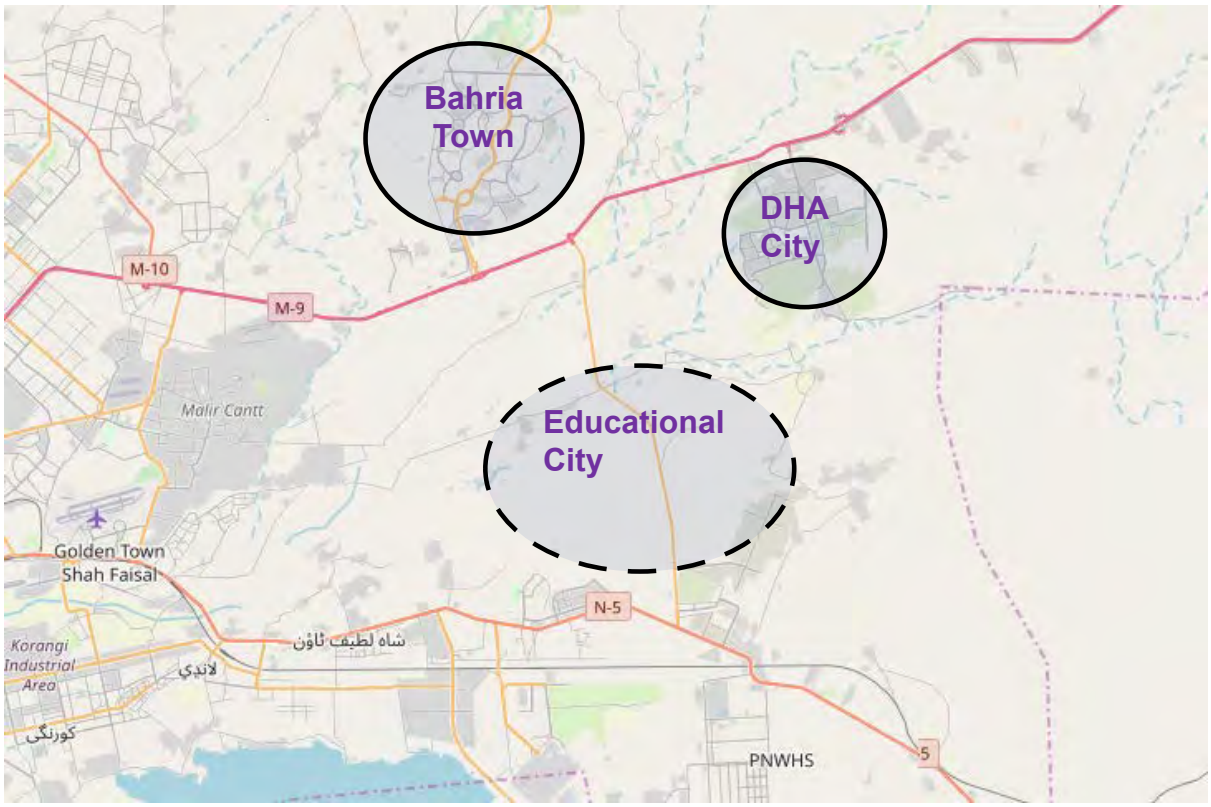


Figure 5.2 Major Planned Projects within the Study Area

5.3 Future Traffic Demand on Malir Expressway

To estimate the traffic demand on Malir Expressway, National Transport Model 2020 developed for Pakistan under the ADB funded project "National Transport Master Plan, Ministry of Planning, Development, and Special Initiatives" was reviewed. To estimate how much existing traffic will divert to Malir Expressway, diversion curves are used to estimate the potential diverting traffic.

5.3.1 VISUM Model for Pakistan

The National Transport Master Plan project was completed in September 2020 under the supervision of the Ministry of Planning, Pakistan. The base transport forecast model was developed under the project using VISUM Software. A total of 162 traffic analysis zones were coded which include 4 external zones. Figure 5.3 shows the coded zones in the VISUM model. The OD Data collected on 218 locations all over Pakistan on major national and provincial highways. Based upon the OD data, and traffic demand on each zone, traffic assignment was run on VISUM to estimate traffic

on each highway or link. The output of model is used to calculate the traffic coming in and going out of Karachi City.

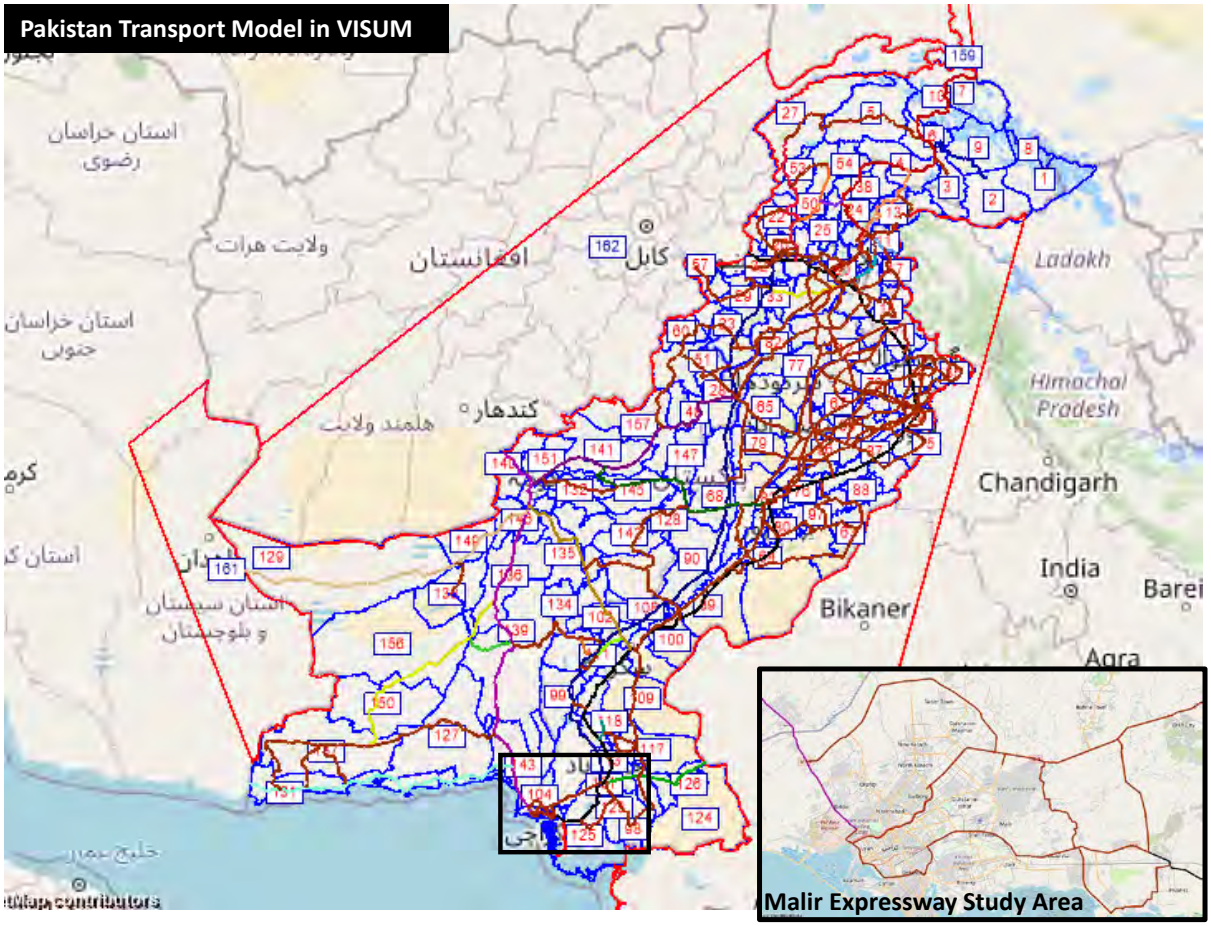


Figure 5.3 National Transport Model for Pakistan 2020
(Source: "National Transport Master Plan, Ministry of Planning, Development, and Special Initiatives")

5.3.2 Estimation of Diverted Traffic

The short path based upon travel time and impedance between the zones was also changed. The consultant performed the OD analysis and estimate the traffic demand based upon the diversion curves. The travel time saving due to Malir Expressway based upon travel time study results were calculated. Figure 5.4 shows the Bureau of Public Roads Diversion Curve, used for the estimation of diverted traffic.

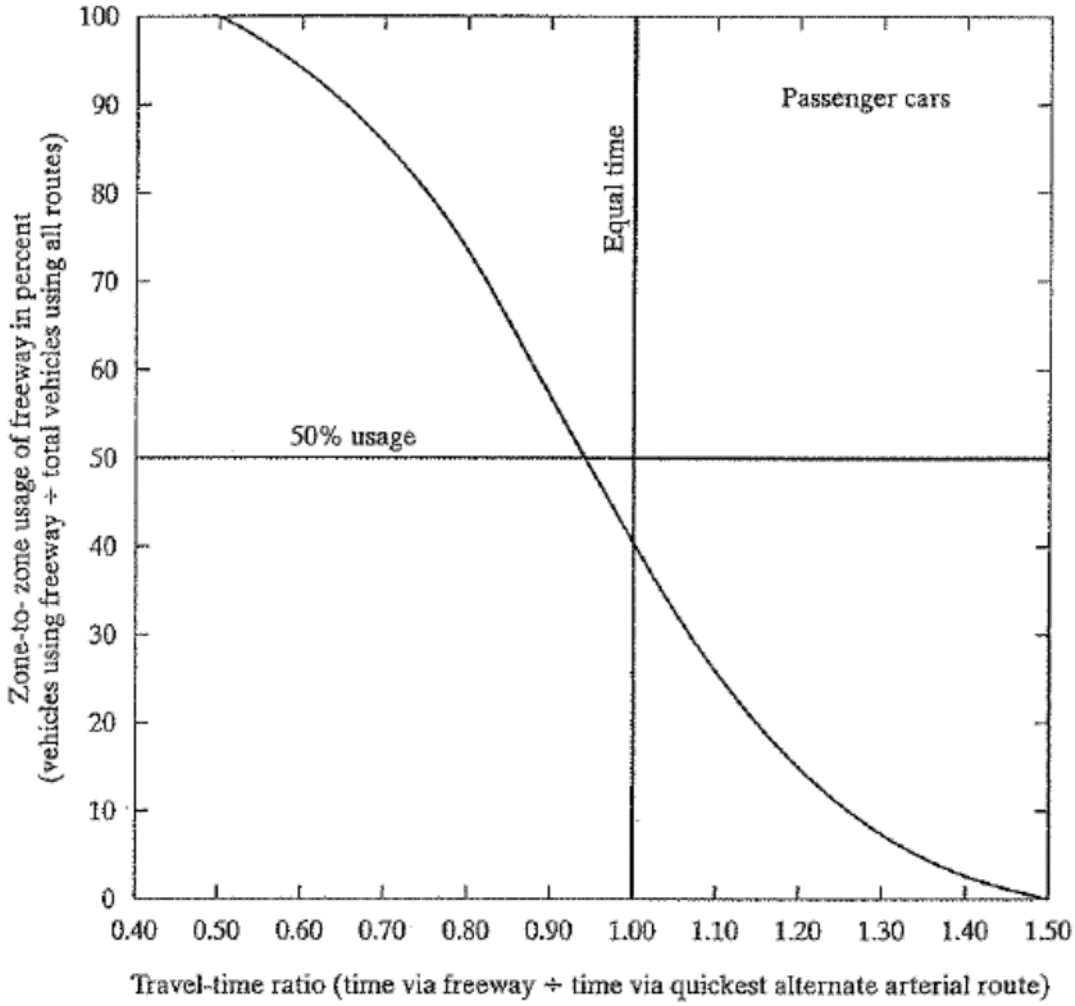


Figure 5.4 Bureau of Public Roads Diversion Curve

5.4 Traffic Demand on Malir Expressway

The traffic demand on the Malir Expressway will be of two types that are diverted traffic and generated traffic. Diverted traffic will be the vehicles that are already in the system and have the potential to change the route for better travel time and vehicle operating cost. Whereas generated traffic is new traffic because of accessibility and upcoming land use development in the nearby vicinity of the Malir Expressway. Table 5.1 shows the estimated travel demand for Malir Expressway. The growth rates are already illustrated in chapter 2 of this report.

Table 5.1 Estimated Traffic Demand on Malir Expressway

Year	Cars	Hiace	Mini Buses	Buses	2-Axle Truck	3-Axle Truck	4-Axle Truck	5-Axle Truck	6-Axle Truck	Total Traffic (Vehicles per Day)
2022	11,442	782	111	882	1,058	1,963	2,415	832	1,285	**20,770**
2023	12,186	822	117	927	1,101	2,042	2,512	866	1,337	**21,910**
2024	12,979	864	123	974	1,146	2,124	2,613	901	1,391	**23,115**
2025	13,823	908	130	1,023	1,192	2,209	2,718	938	1,447	**24,388**
2026	14,722	954	137	1,075	1,240	2,298	2,827	976	1,505	**25,734**
2027	15,679	1,002	144	1,129	1,290	2,390	2,941	1,016	1,566	**27,157**
2028	16,542	1,043	150	1,175	1,336	2,474	3,044	1,052	1,621	**28,437**
2029	17,452	1,085	156	1,222	1,383	2,561	3,151	1,089	1,678	**29,777**
2030	18,412	1,129	163	1,271	1,432	2,651	3,262	1,128	1,737	**31,185**
2031	19,425	1,175	170	1,322	1,483	2,744	3,377	1,168	1,798	**32,662**
2032	20,494	1,222	177	1,375	1,535	2,841	3,496	1,209	1,861	**34,210**
2033	21,622	1,271	185	1,430	1,589	2,941	3,619	1,252	1,927	**35,836**
2034	22,812	1,322	193	1,488	1,645	3,044	3,746	1,296	1,995	**37,541**
2035	24,067	1,375	201	1,548	1,703	3,151	3,878	1,342	2,065	**39,330**
2036	25,391	1,430	210	1,610	1,763	3,262	4,014	1,389	2,138	**41,207**
2037	26,788	1,488	219	1,675	1,825	3,377	4,155	1,438	2,213	**43,178**
2038	28,262	1,548	228	1,742	1,889	3,496	4,301	1,489	2,291	**45,246**
2039	29,817	1,610	238	1,812	1,956	3,619	4,452	1,542	2,372	**47,418**
2040	31,457	1,675	248	1,885	2,025	3,746	4,608	1,596	2,456	**49,696**
2041	33,188	1,742	258	1,961	2,096	3,878	4,770	1,652	2,542	**52,087**
2042	35,014	1,812	269	2,040	2,170	4,014	4,937	1,710	2,631	**54,597**

Annex VI – Traffic Forecast Analysis

CONSTRUCTION OF MALIR EXPRESSWAY
FROM MOTORWAY M9 TO KPT INTERCHANGE
KARACHI

C A P A C I T Y A N A L Y S I S
(UNDER IMPROVED UNINTERRUPTED FLOW CONDITION ON ACCESS CONTROLLED FACILITY)

Table 3.5.5.1

DESIGN CRITERIA :

HIGHWAY CLASSIFICATION 6-Lane Freeway	LATERAL CLEARANCE	TERRAIN TYPE: LEVEL	DRIVER POPULAT COMMUTERS
DESIGN SPEED: 100km/hr (60 mph)	ROAD SIDE 2M	DIRECTION :	ANALSYSIS SCENARIO: 1
FREE FLOW SPEED: 80.45 km / hr (50 mph)	MEDIAN VARIES		

NO. LANES ON THE PROPOSED FACILITY (N)	= 3	V/C RATIO ---------- LOS A =	-
ADJUSTMENT FACTOR FOR DRIVER POPULATION (fp)	= 1.00	V/C RATIO ---------- LOS B =	0.490
LANE ADJUSTMENT FACTOR (fw)	= 1.00	V/C RATIO ---------- LOS C =	0.690
PC EQUIVALENT BUSES (E_B)	= 1.60	V/C RATIO ---------- LOS D =	0.840
PC EQUIVALENT TRUCKS AND TRAILERS (ET)	= 1.70	V/C RATIO ---------- LOS E =	1.000

(v/c from Table 3-1, for 60 mph Design Speed)

Note : *This analysis is based on the procedures outlined in the Highway Capacity Manual - 1994 Edition (Special Report 209), published by the Transportation Research Board, National Research Council, U.S.A. Necessary Adjustments, as already mentioned, have been made to reflect the actual project conditions.*

YEAR		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
						1st Year of Operation	Uninterrupted Traffic Flow Condition								10th Year of Operation										20th Year of Operation					25th Year of Operation
Total Volume of Traffic Mix	**VPD**	33316	34982	37279	39758	42434	45326	48453	51836	54440	57179	60062	63096	66289	69650	73189	76914	80835	84964	87937	91015	94200	97497	100909	104441	108097	111880	115796	119849	124044
	PCU'S	46287	48602	51444	54489	57754	61260	65024	69069	72363	75819	79448	83257	87257	91456	95868	100501	105365	110475	114341	118343	122485	126771	131208	135800	140554	145473	150565	155835	161290
PERCENT BUSES		0.065	0.065	0.064	0.063	0.061	0.060	0.058	0.057	0.057	0.056	0.056	0.055	0.055	0.054	0.054	0.053	0.053	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052
PERCENT TRUCKS		0.540	0.540	0.529	0.518	0.507	0.496	0.485	0.473	0.469	0.466	0.462	0.458	0.454	0.450	0.446	0.442	0.438	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434
FACTOR FOR HEAVY VEHICLE (f_{HV})		0.71	0.71	0.71	0.71	0.72	0.72	0.73	0.73	0.73	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
ALLOWABLE FLOW RATES*																														
SERVICE FLOW RATE - LOS A																														
SERVICE FLOW RATE - LOS B		2075	2075	2087	2100	2113	2126	2139	2153	2158	2163	2167	2172	2177	2182	2187	2192	2197	2202	2202	2202	2202	2202	2202	2202	2202	2202	2202	2202	2202
SERVICE FLOW RATE - LOS C		2922	2922	2939	2957	2975	2993	3012	3032	3038	3045	3052	3059	3066	3073	3080	3087	3094	3101	3101	3101	3101	3101	3101	3101	3101	3101	3101	3101	3101
SERVICE FLOW RATE - LOS D		3557	3557	3578	3599	3621	3644	3667	3691	3699	3707	3715	3724	3732	3741	3749	3758	3766	3775	3775	3775	3775	3775	3775	3775	3775	3775	3775	3775	3775
SERVICE FLOW RATE - LOS E		4235	4235	4259	4285	4311	4338	4366	4394	4404	4413	4423	4433	4443	4453	4463	4473	4483	4494	4494	4494	4494	4494	4494	4494	4494	4494	4494	4494	4494
Peak hour percentage factor "K"	0.070																													
Directional distribution factor "D"	0.500																													
Hourly Volume at the freeway (In one direction)		1620	1701	1801	1907	2021	2144	2276	2417	2533	2654	2781	2914	3054	3201	3355	3518	3688	3867	4002	4142	4287	4437	4592	4753	4919	5092	5270	5454	5645
Peak Hour Factor, PHF		0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Actual Flow rate at the highway (in one direction)		1761	1849	1957	2073	2197	2331	2474	2628	2753	2884	3022	3167	3320	3479	3647	3823	4008	4203	4350	4502	4660	4823	4992	5166	5347	5534	5728	5929	6136

* Cj=2000

LEVEL OF SERVICE	B	C	D	E

CONSTRUCTION OF MALIR EXPRESSWAY
FROM MOTORWAY M9 TO KPT INTERCHANGE
KARACHI

C A P A C I T Y A N A L Y S I S
(UNDER IMPROVED UNINTERRUPTED FLOW CONDITION ON ACCESS CONTROLLED FACILITY)

Table 3.5.5.2

DESIGN CRITERIA :

HIGHWAY CLASSIFICATION 6-Lane Freeway	LATERAL CLEARANCE	TERRAIN TYPE: LEVEL	DRIVER POPULAT COMMUTERS
DESIGN SPEED: 100km/hr (60 mph)	ROAD SIDE 2M	DIRECTION :	ANALSYSIS SCENARIO: 2
FREE FLOW SPEED: 80.45 km / hr (50 mph)	MEDIAN VARIES		

NO. LANES ON THE PROPOSED FACILITY (N)	= 3	V/C RATIO ---------- LOS A =	-
ADJUSTMENT FACTOR FOR DRIVER POPULATION (fp)	= 1.00	V/C RATIO ---------- LOS B =	0.490
LANE ADJUSTMENT FACTOR (fw)	= 1.00	V/C RATIO ---------- LOS C =	0.690
PC EQUIVALENT BUSES (E_B)	= 1.60	V/C RATIO ---------- LOS D =	0.840
PC EQUIVALENT TRUCKS AND TRAILERS (ET)	= 1.70	V/C RATIO ---------- LOS E =	1.000

(v/c from Table 3-1, for 60 mph Design Speed)

Note : *This analysis is based on the procedures outlined in the Highway Capacity Manual - 1994 Edition (Special Report 209), published by the Transportation Research Board, National Research Council, U.S.A. Necessary Adjustments, as already mentioned, have been made to reflect the actual project conditions.*

YEAR		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
						1st Year of Operation	Uninterrupted Traffic Flow Condition								10th Year of Operation										20th Year of Operation					25th Year of Operation
Total Volume of Traffic Mix	**VPD**	9003	9453	10030	10651	11318	12036	12810	13643	14306	15003	15735	16505	17314	18164	19058	19997	20984	22023	22794	23592	24417	25272	26156	27071	28019	29000	30016	31067	32155
	PCU'S	12855	13497	14236	15025	15867	16767	17731	18760	19628	20538	21491	22491	23540	24639	25792	27000	28267	29598	30634	31706	32815	33964	35153	36382	37656	38975	40341	41753	43215
PERCENT BUSES		0.0651	0.0651	0.0638	0.0625	0.0611	0.0598	0.0584	0.057	0.0566	0.0561	0.0557	0.0551	0.0547	0.0542	0.0537	0.0533	0.0528	0.0523	0.0523	0.0523	0.0523	0.0524	0.0523	0.0523	0.0524	0.0523	0.0524	0.0524	0.0524
PERCENT TRUCKS		0.5398	0.5398	0.5291	0.5182	0.5072	0.496	0.4847	0.4733	0.4694	0.4655	0.4616	0.4577	0.4537	0.4498	0.4458	0.4419	0.438	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434
FACTOR FOR HEAVY VEHICLE (f_{HV})		0.71	0.71	0.71	0.71	0.72	0.72	0.73	0.73	0.73	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
ALLOWABLE FLOW RATES*																														
SERVICE FLOW RATE - LOS A																														
SERVICE FLOW RATE - LOS B		1971	1971	1983	1995	2007	2019	2032	2045	2050	2054	2059	2064	2068	2073	2078	2082	2087	2092	2092	2092	2092	2092	2092	2092	2092	2092	2092	2092	2092
SERVICE FLOW RATE - LOS C		2776	2776	2792	2809	2826	2844	2862	2880	2887	2893	2899	2906	2912	2919	2926	2932	2939	2946	2946	2946	2946	2946	2946	2946	2946	2946	2946	2946	2946
SERVICE FLOW RATE - LOS D		3379	3379	3399	3419	3440	3462	3484	3506	3514	3522	3530	3538	3546	3554	3562	3570	3578	3586	3586	3586	3586	3586	3586	3586	3586	3586	3586	3586	3586
SERVICE FLOW RATE - LOS E		4023	4023	4046	4071	4096	4121	4147	4174	4183	4193	4202	4211	4221	4230	4240	4250	4259	4269	4269	4269	4269	4269	4269	4269	4269	4269	4269	4269	4269
Peak hour percentage factor "K"	0.150																													
Directional distribution factor "D"	0.560																													
Hourly Volume at the freeway (In one direction)		1080	1134	1196	1262	1333	1408	1489	1576	1649	1725	1805	1889	1977	2070	2167	2268	2374	2486	2573	2663	2756	2853	2953	3056	3163	3274	3389	3507	3630
Peak Hour Factor, PHF		0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Actual Flow rate at the highway (in one direction)		1200	1260	1329	1402	1481	1565	1655	1751	1832	1917	2006	2099	2197	2300	2407	2520	2638	2762	2859	2959	3063	3170	3281	3396	3515	3638	3765	3897	4033
* Cj=1900																														
LEVEL OF SERVICE		**B**											**C**								**D**						**E**			

FROM MOTORWAY M9 TO KPT INTERCHANGE
KARACHI
C A P A C I T Y A N A L Y S I S
(UNDER IMPROVED UNINTERRUPTED FLOW CONDITION ON ACCESS CONTROLLED FACILITY)

Table 3.5.5.3

DESIGN CRITERIA :

HIGHWAY CLASSIFICATION 6-Lane Freeway	LATERAL CLEARANCE	TERRAIN TYPE: LEVEL	DRIVER POPULAT COMMUTERS
DESIGN SPEED: 100km/hr (60 mph)	ROAD SIDE 2M	DIRECTION :	ANALSYSIS SCENARIO: 3
FREE FLOW SPEED: 80.45 km / hr (50 mph)	MEDIAN VARIES		

NO. LANES ON THE PROPOSED FACILITY (N)	= 3	V/C RATIO ---------- LOS A =	-
ADJUSTMENT FACTOR FOR DRIVER POPULATION (fp)	= 1.00	V/C RATIO ---------- LOS B =	0.490
LANE ADJUSTMENT FACTOR (fw)	= 1.00	V/C RATIO ---------- LOS C =	0.690
PC EQUIVALENT BUSES (E_B)	= 1.60	V/C RATIO ---------- LOS D =	0.840
PC EQUIVALENT TRUCKS AND TRAILERS (ET)	= 1.70	V/C RATIO ---------- LOS E =	1.000

(v/c from Table 3-1, for 60 mph Design Speed)

Note : *This analysis is based on the procedures outlined in the Highway Capacity Manual - 1994 Edition (Special Report 209), published by the Transportation Research Board, National Research Council, U.S.A. Necessary Adjustments, as already mentioned, have been made to reflect the actual project conditions.*

YEAR		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
						1st Year of Operation	Uninterrupted Traffic Flow Condition								10th Year of Operation										20th Year of Operation					25th Year of Operation
Total Volume of Traffic Mix	**VPD**	18720	19656	20941	22327	23824	25440	27188	29079	30537	32070	33684	35382	37168	39049	41029	43113	45307	47616	49283	51008	52794	54642	56555	58535	60584	62704	64898	67170	69521
	PCU'S	26024	27324	28916	30621	32450	34411	36518	38782	40629	42565	44599	46734	48973	51327	53798	56393	59119	61980	64150	66395	68720	71125	73615	76193	78860	81620	84476	87433	90493
PERCENT BUSES		0.035	0.035	0.034	0.033	0.032	0.031	0.031	0.030	0.029	0.029	0.029	0.029	0.028	0.028	0.028	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027
PERCENT TRUCKS		0.519	0.519	0.507	0.494	0.482	0.469	0.457	0.444	0.440	0.436	0.431	0.427	0.423	0.418	0.414	0.410	0.406	0.402	0.401	0.402	0.402	0.402	0.402	0.402	0.402	0.402	0.402	0.402	0.402
FACTOR FOR HEAVY VEHICLE (f_{HV})		0.72	0.72	0.73	0.73	0.74	0.74	0.75	0.75	0.75	0.76	0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
ALLOWABLE FLOW RATES*																														
SERVICE FLOW RATE - LOS A																														
SERVICE FLOW RATE - LOS B		2018	2018	2031	2045	2059	2073	2087	2102	2107	2112	2117	2122	2127	2132	2138	2143	2148	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153
SERVICE FLOW RATE - LOS C		2841	2841	2860	2879	2899	2919	2939	2960	2967	2974	2981	2988	2996	3003	3010	3017	3025	3032	3032	3032	3032	3032	3032	3032	3032	3032	3032	3032	3032
SERVICE FLOW RATE - LOS D		3459	3459	3482	3505	3529	3554	3578	3603	3612	3621	3629	3638	3647	3656	3664	3673	3682	3691	3691	3691	3691	3691	3691	3691	3691	3691	3691	3691	3691
SERVICE FLOW RATE - LOS E		4118	4118	4145	4173	4201	4230	4260	4290	4300	4310	4321	4331	4342	4352	4362	4373	4384	4394	4394	4394	4394	4394	4394	4394	4394	4394	4394	4394	4394
Peak hour percentage factor "K"	0.085																													
Directional distribution factor "D"	0.520																													
Hourly Volume at the freeway (In one direct		1150	1208	1278	1353	1434	1521	1614	1714	1796	1881	1971	2066	2165	2269	2378	2493	2613	2740	2835	2935	3037	3144	3254	3368	3486	3608	3734	3865	4000
Peak Hour Factor, PHF		0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Actual Flow rate at the highway (in one dire		1250	1313	1389	1471	1559	1653	1754	1863	1952	2045	2143	2245	2353	2466	2585	2709	2840	2978	3082	3190	3302	3417	3537	3661	3789	3921	4059	4201	4348

* Cj=1900

LEVEL OF SERVICE	B	C	D	E

Annex VII – Affected Structures Map

NOTES:-

1. ALL DIMENSIONS ARE IN METER UNITS.
2. ALL COORDINATES ARE WITH RESPECT TO WGS84 DATUM AND UTM PROJECTION ZONE 42
   OBSERVED USING DUAL FREQUENCY GPS AT DATUM STATIONS BM1 & BM2.
   VALUES OF THESE DATUM STATIONS ARE AS FOLLOWS:

   WGS84 SPHERICAL COORDINATES
   BM1 24°49'23.51997"N 67°05'12.72817"E
   BM2 24°49'34.42707"N 67°05'11.64646"E

   UTM 42 ZONE GRID COORDINATES
   BM1 E=306647.733m N=2746726.706m
   BM2 E=306622.065m N=2747062.726m

3. VERTICAL DATUM TRANSFERRED FROM MONUMENT S-50 FIXED ON ROOF TOP OF MARINA CLUB DINNING HALL
   THE VALUES OF MONUMENT ARE:
   LATITUDE=24°47'46.979"N LONGITUDE=67°04'48.976"E
   HEIGHT WITH REFERENCE TO PQA BUNDAL DATUM =11.575m
4. DIFFERENCE OF SOP AND PQ ZERO ELEVATION DATUMS
   THE DIFFERENCE BETWEEN PORT QASIM (PQ) PIPRI DATUM AND SOP DATUM IS 1.821m WITH THE PQ DATUM SET LOWER. THE SOP DATUM IS BASED ON MEAN SEA LEVEL WHILE THE PQ DATUM IS BASED ON A CHART DATUM ESTABLISHED AT PIPRI.

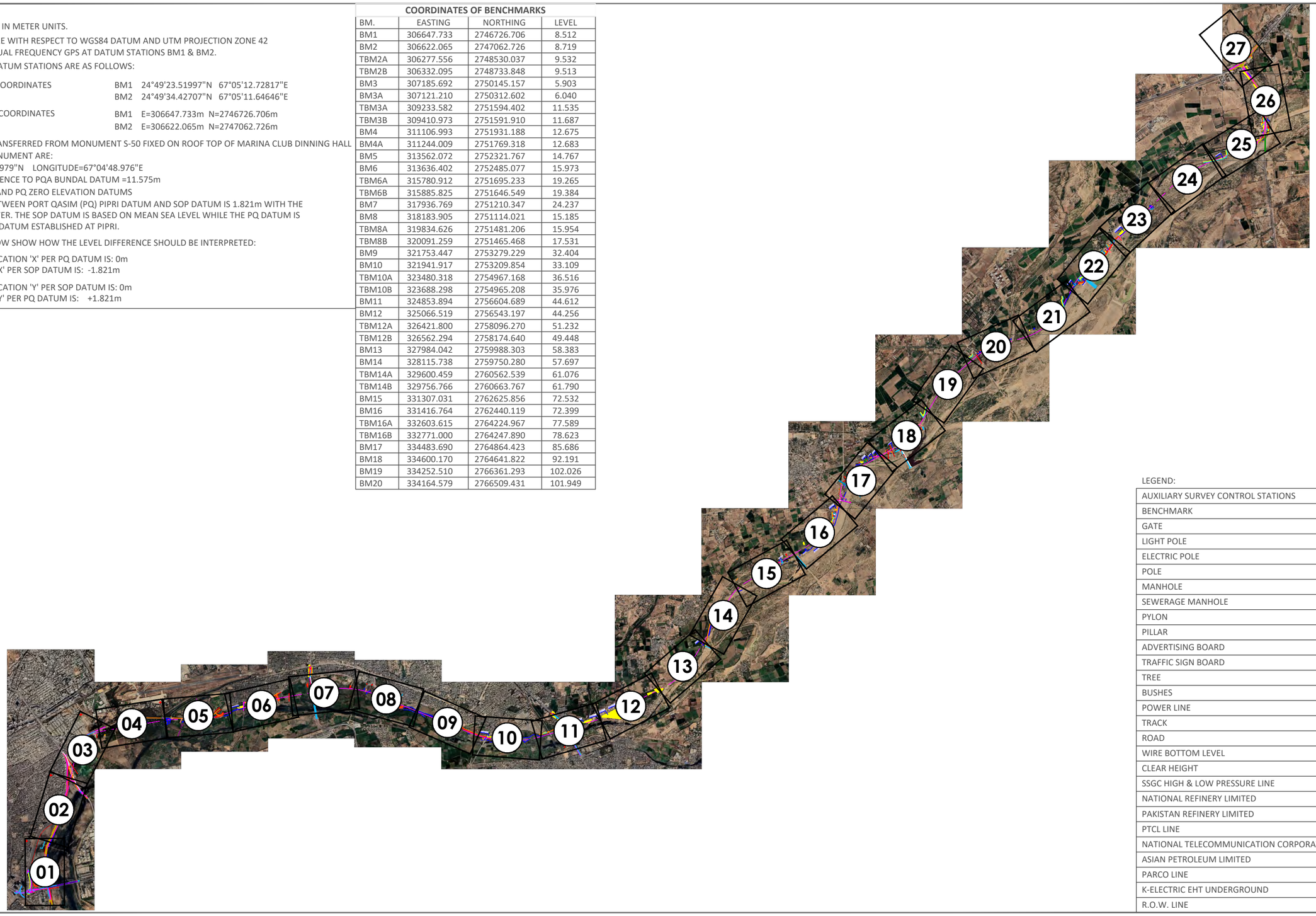
   THE EXAMPLES BELOW SHOW HOW THE LEVEL DIFFERENCE SHOULD BE INTERPRETED:

   IF ELEVATION AT LOCATION 'X' PER PQ DATUM IS: 0m
   THE ELEVATION AT 'X' PER SOP DATUM IS: -1.821m

   IF ELEVATION AT LOCATION 'Y' PER SOP DATUM IS: 0m
   THE ELEVATION AT 'Y' PER PQ DATUM IS: +1.821m

COORDINATES OF BENCHMARKS

BM.	EASTING	NORTHING	LEVEL
BM1	306647.733	2746726.706	8.512
BM2	306622.065	2747062.726	8.719
TBM2A	306277.556	2748530.037	9.532
TBM2B	306332.095	2748733.848	9.513
BM3	307185.692	2750145.157	5.903
BM3A	307121.210	2750312.602	6.040
TBM3A	309233.582	2751594.402	11.535
TBM3B	309410.973	2751591.910	11.687
BM4	311106.993	2751931.188	12.675
BM4A	311244.009	2751769.318	12.683
BM5	313562.072	2752321.767	14.767
BM6	313636.402	2752485.077	15.973
TBM6A	315780.912	2751695.233	19.265
TBM6B	315885.825	2751646.549	19.384
BM7	317936.769	2751210.347	24.237
BM8	318183.905	2751114.021	15.185
TBM8A	319834.626	2751481.206	15.954
TBM8B	320091.259	2751465.468	17.531
BM9	321753.447	2753279.229	32.404
BM10	321941.917	2753209.854	33.109
TBM10A	323480.318	2754967.168	36.516
TBM10B	323688.298	2754965.208	35.976
BM11	324853.894	2756604.689	44.612
BM12	325066.519	2756543.197	44.256
TBM12A	326421.800	2758096.270	51.232
TBM12B	326562.294	2758174.640	49.448
BM13	327984.042	2759988.303	58.383
BM14	328115.738	2759750.280	57.697
TBM14A	329600.459	2760562.539	61.076
TBM14B	329756.766	2760663.767	61.790
BM15	331307.031	2762625.856	72.532
BM16	331416.764	2762440.119	72.399
TBM16A	332603.615	2764224.967	77.589
TBM16B	332771.000	2764247.890	78.623
BM17	334483.690	2764864.423	85.686
BM18	334600.170	2764641.822	92.191
BM19	334252.510	2766361.293	102.026
BM20	334164.579	2766509.431	101.949



LEGEND:

AUXILIARY SURVEY CONTROL STATIONS	△
BENCHMARK	◔
GATE	⊠
LIGHT POLE	
ELECTRIC POLE	Ⓔ
POLE	○
MANHOLE	□
SEWERAGE MANHOLE	Ⓢ
PYLON	⊠
PILLAR	⊞
ADVERTISING BOARD	
TRAFFIC SIGN BOARD	
TREE	
BUSHES	
POWER LINE	
TRACK	
ROAD	
WIRE BOTTOM LEVEL	WBL=
CLEAR HEIGHT	CLR HT=
SSGC HIGH & LOW PRESSURE LINE	
NATIONAL REFINERY LIMITED	
PAKISTAN REFINERY LIMITED	
PTCL LINE	
NATIONAL TELECOMMUNICATION CORPORATION	
ASIAN PETROLEUM LIMITED	
PARCO LINE	
K-ELECTRIC EHT UNDERGROUND	
R.O.W. LINE	

CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED

CLIENT:-

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 01 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

SHEET INDEX

PREPARED BY
RAMEEZ UL ISLAM

CHECKED & APPROVED BY
SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 01 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-01

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CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
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CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 02 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-02

PREPARED BY

RAMEEZ UL ISLAM

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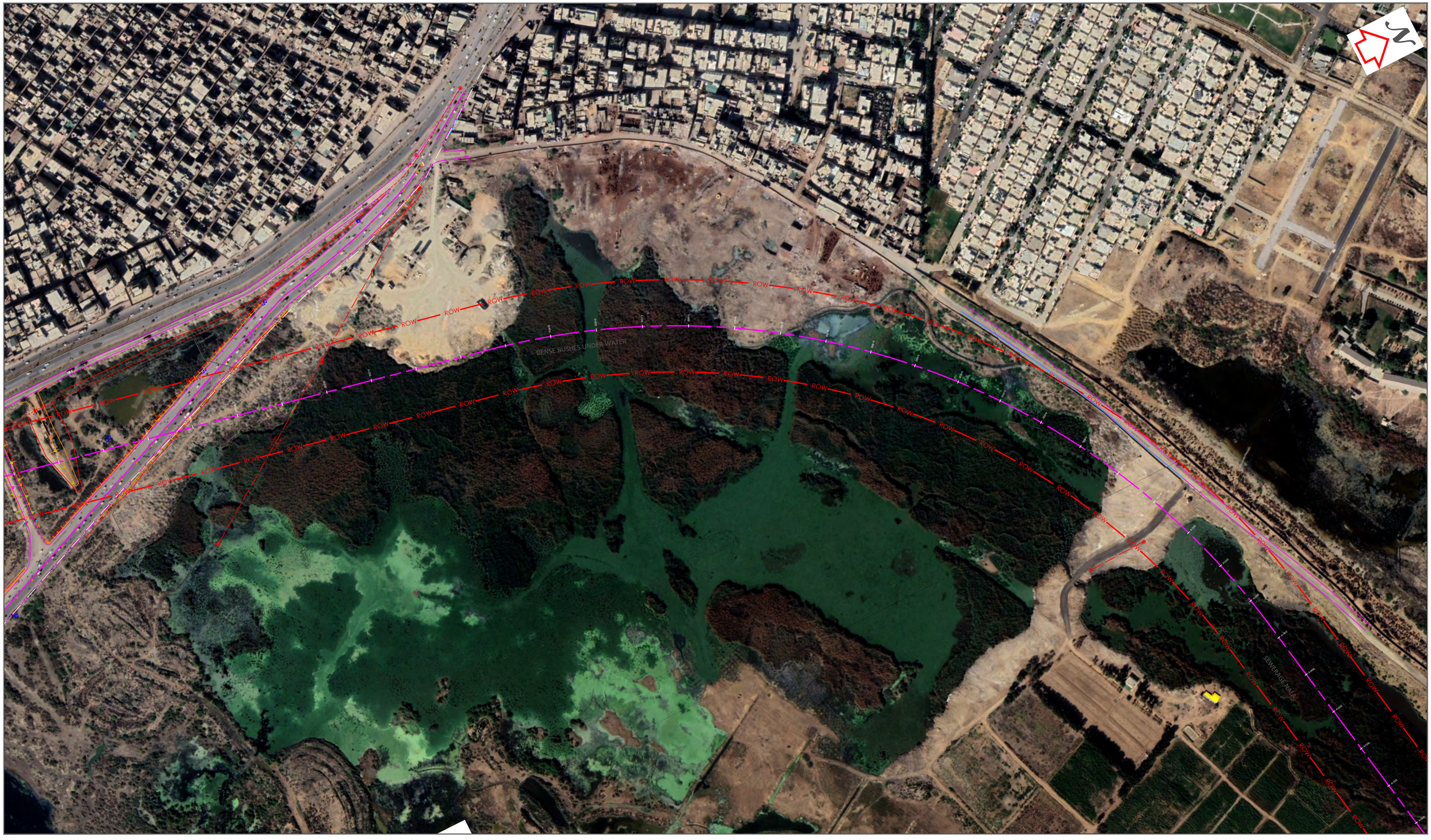
SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 03 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-03

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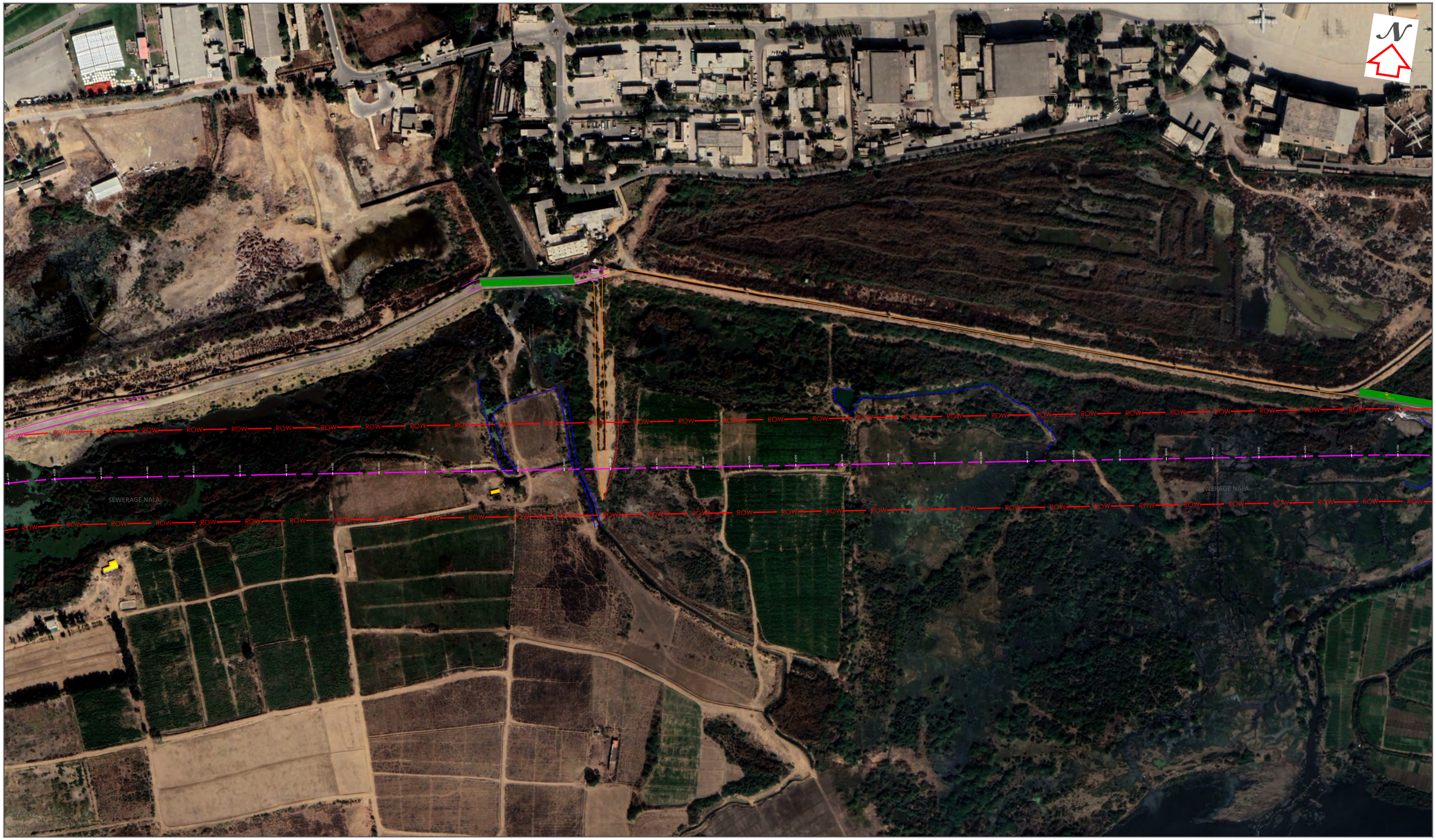
NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 04 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-04

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SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
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CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 05 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-05

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RAMEEZ UL ISLAM

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SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
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CLIENT:-

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PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 06 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-06

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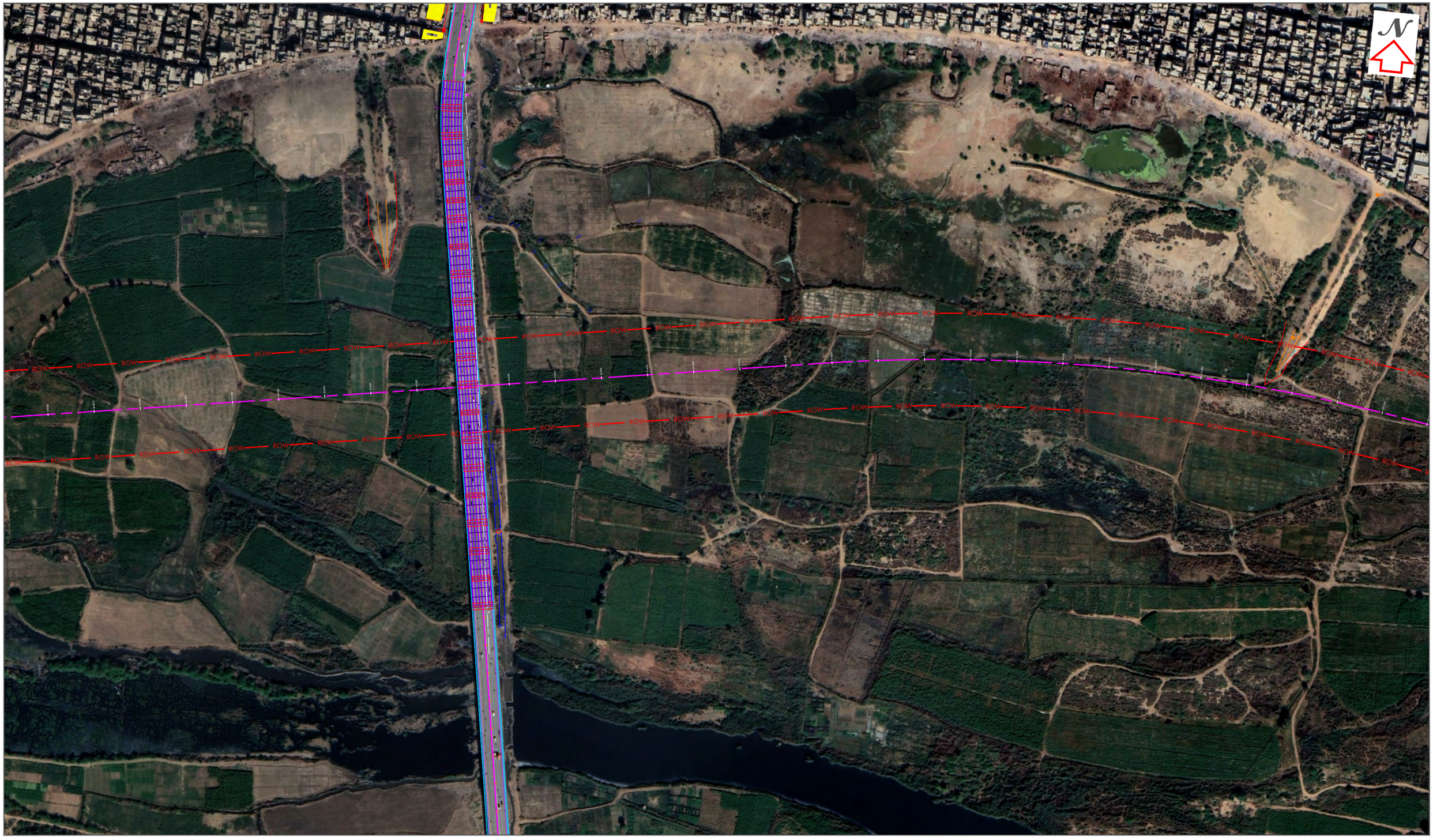
SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 07 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-07

PREPARED BY

RAMEEZ UL ISLAM

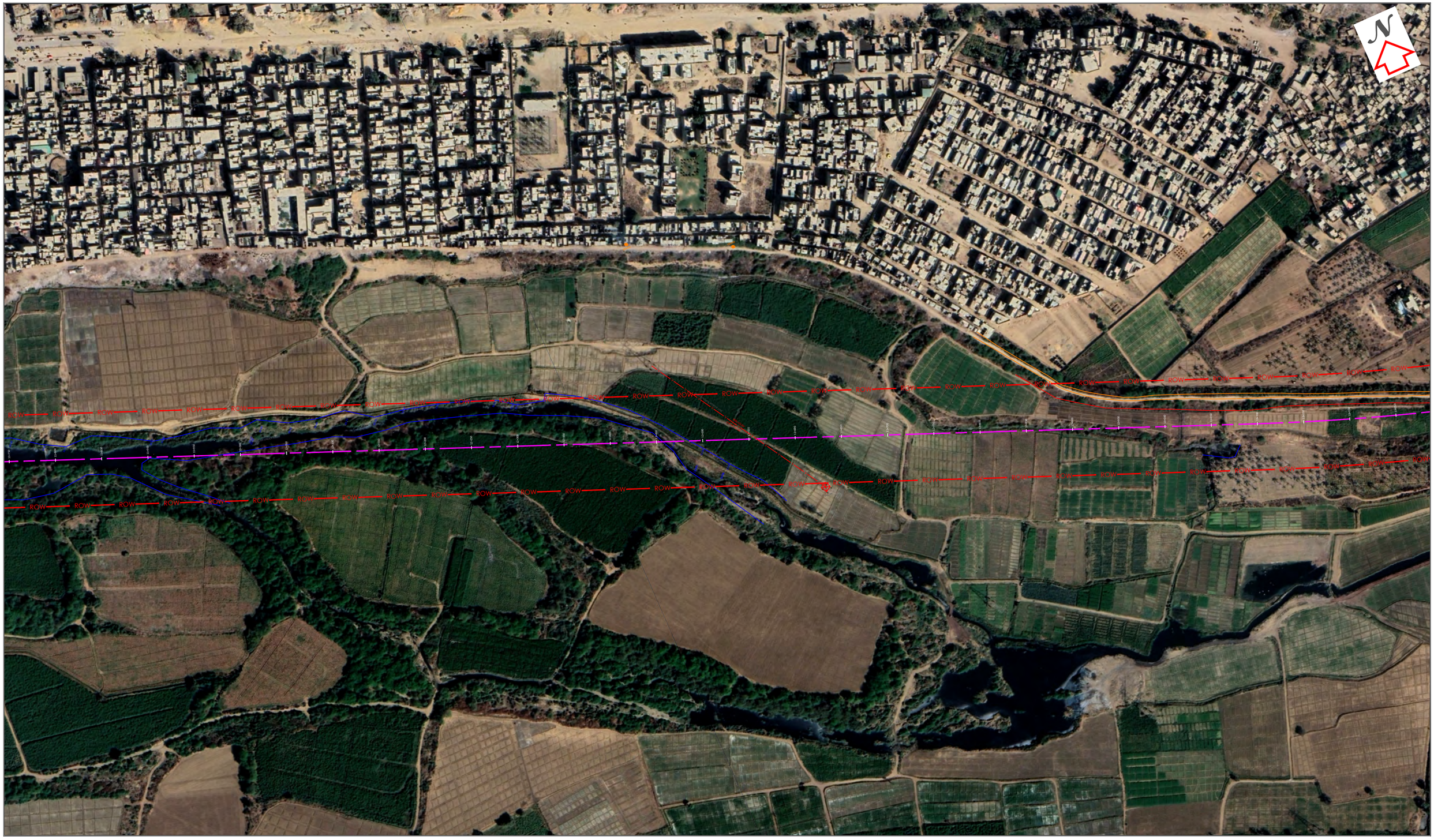
CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 08 OF 27)	PREPARED BY: RAMEEZ UL ISLAM CHECKED & APPROVED BY: SYED OMAR ARIF	NOTES:-
			SHEET SIZE: (A1) / SCALE: 1:500 / DATE: OCTOBER 2021 Drawing No.: ME-08		



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 09 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-09

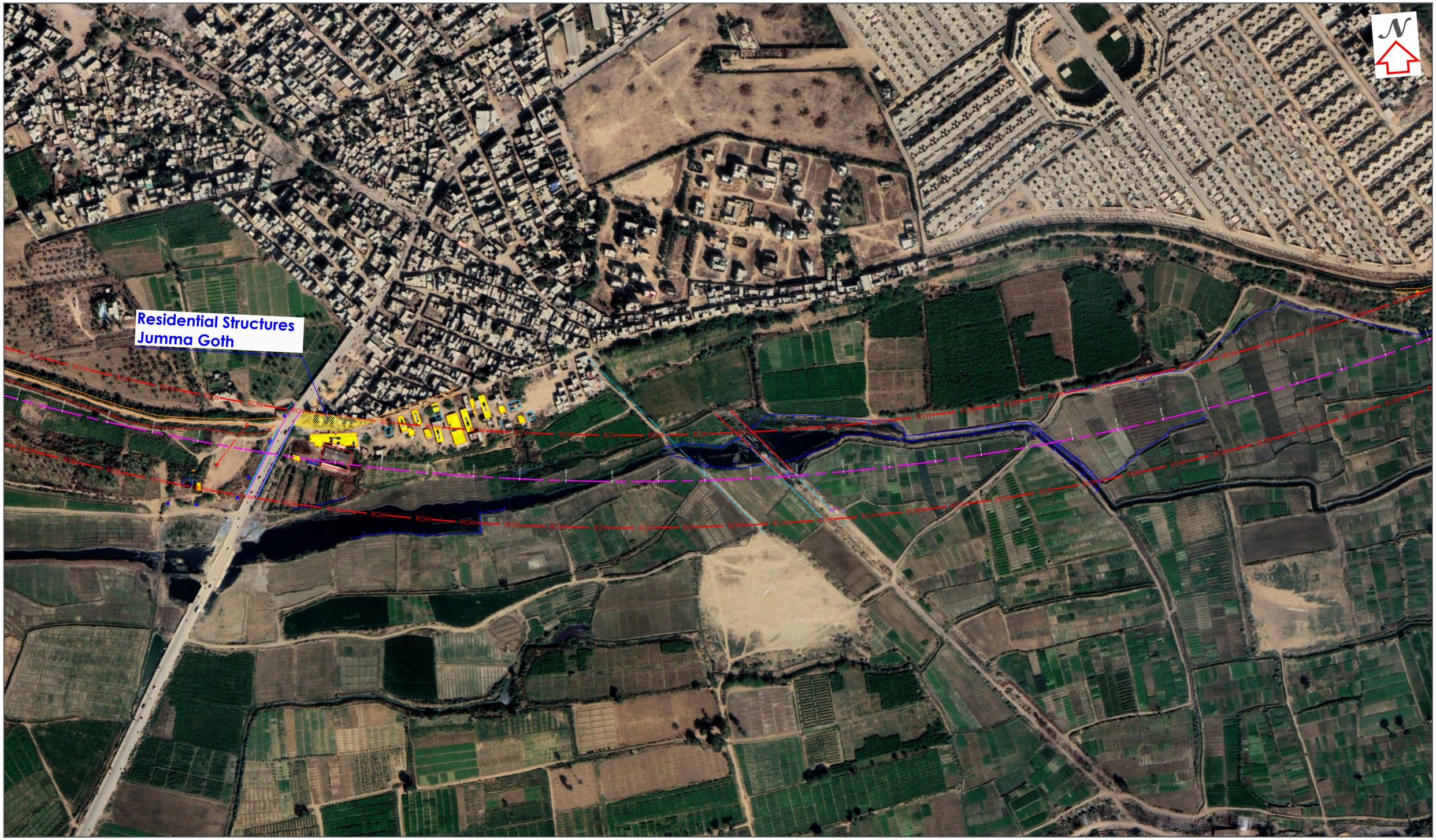
PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

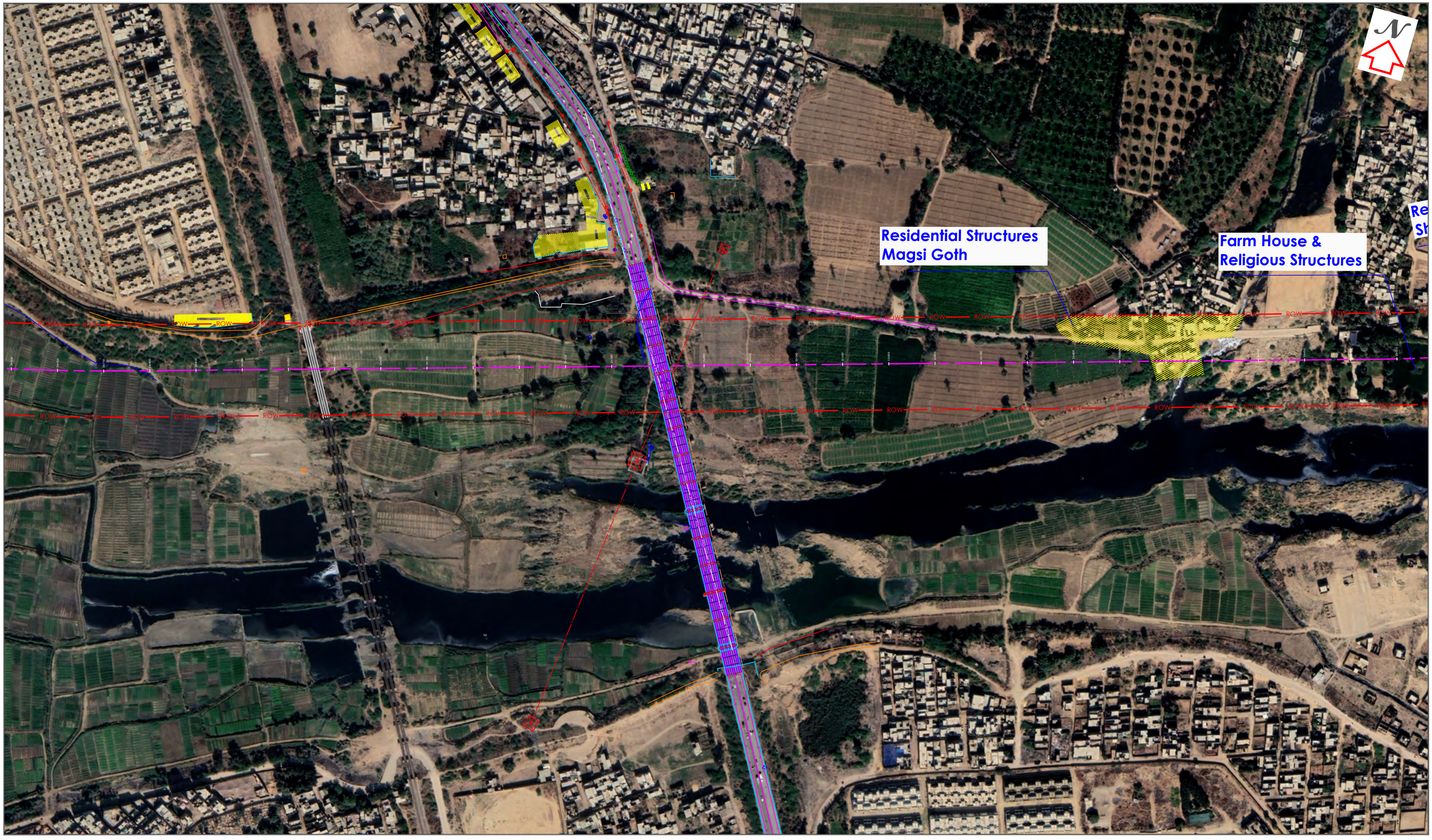
NOTES:-



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 10 OF 27)	PREPARED BY: RAMEEZ UL ISLAM CHECKED & APPROVED BY: SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No. ME-10



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
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CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 11 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-11

PREPARED BY

RAMEEZ UL ISLAM

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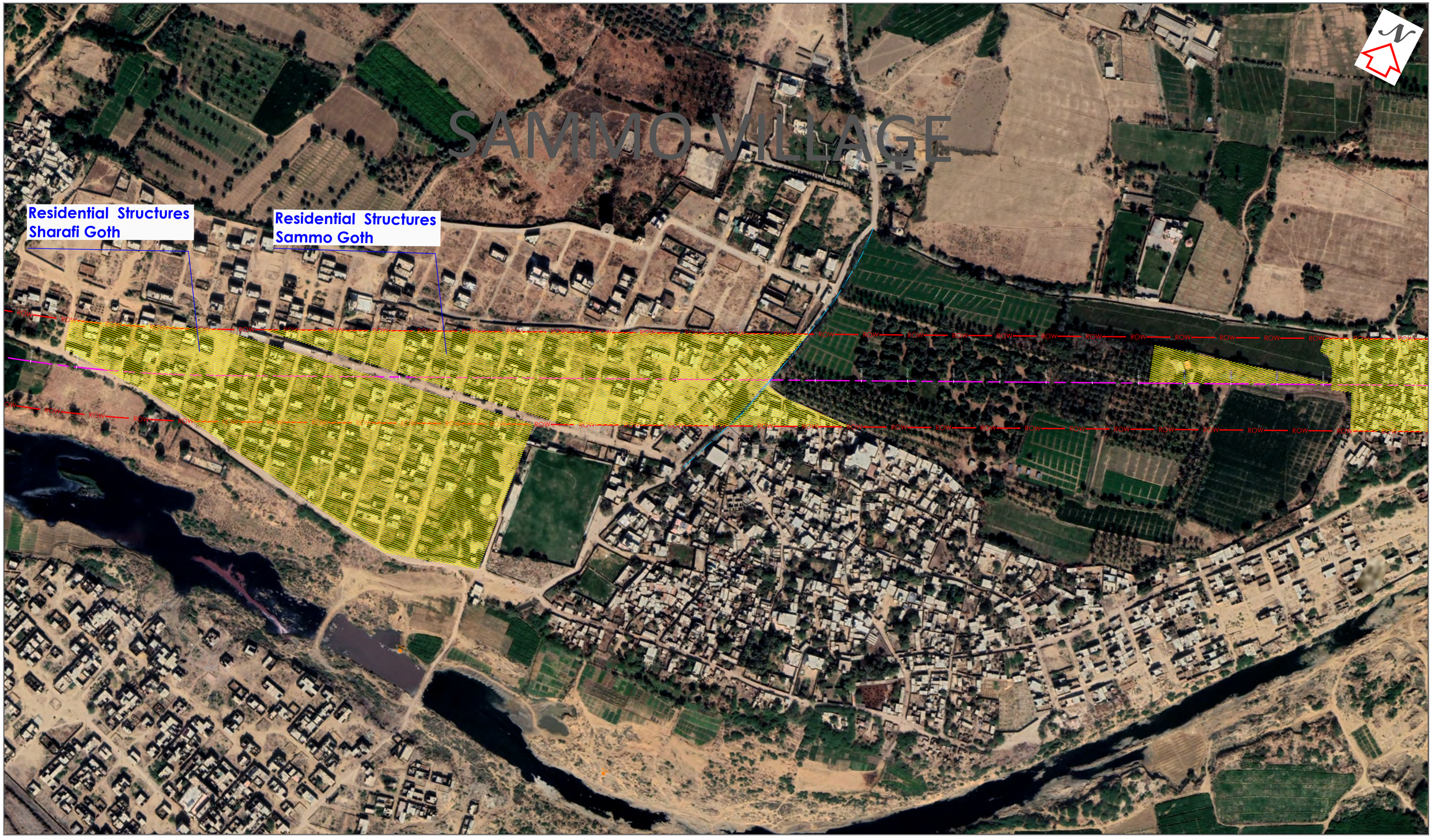
SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 12 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-12

PREPARED BY

RAMEEZ UL ISLAM

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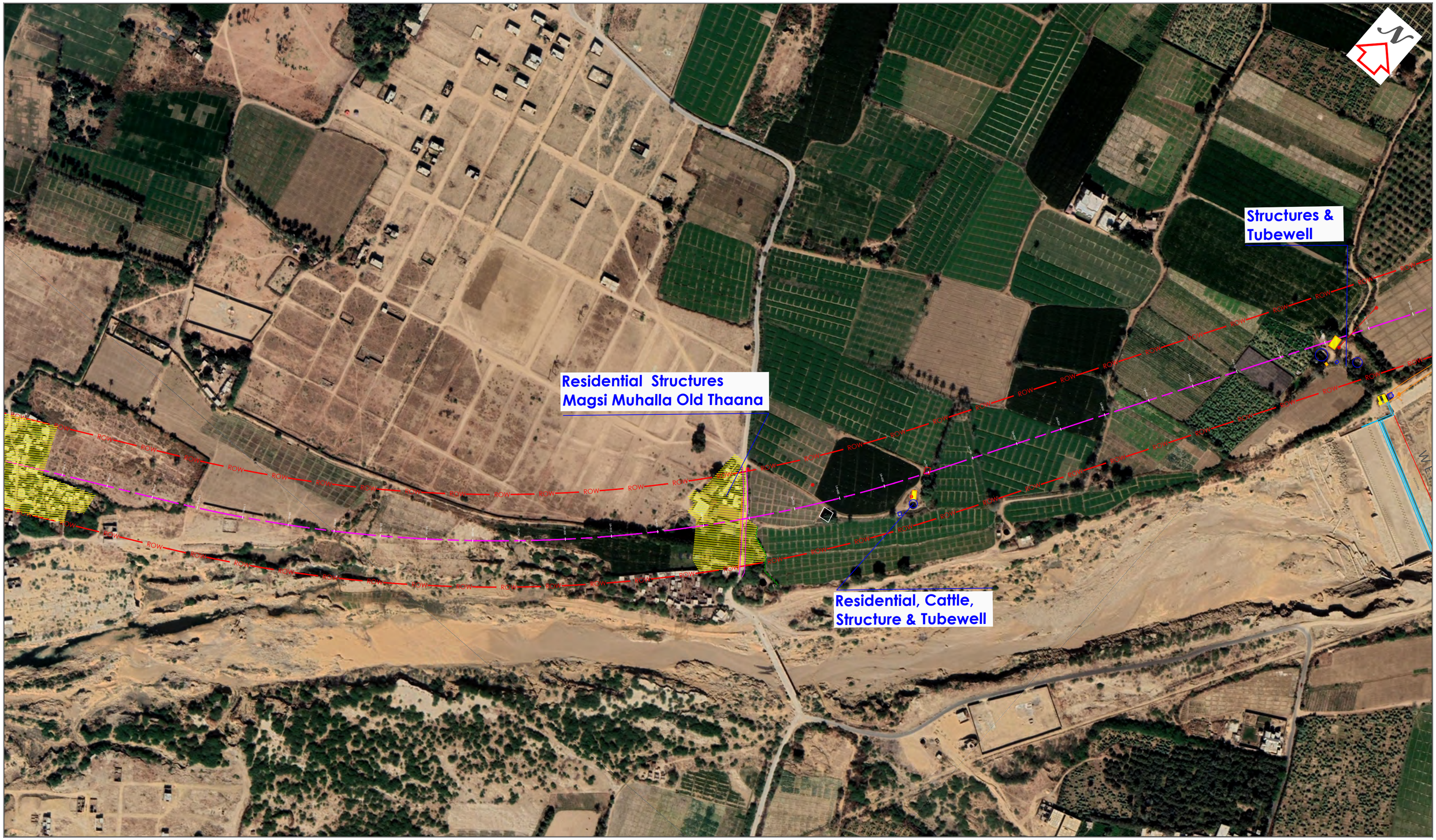
SYED OMAR ARIF

NOTES:-



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 13 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

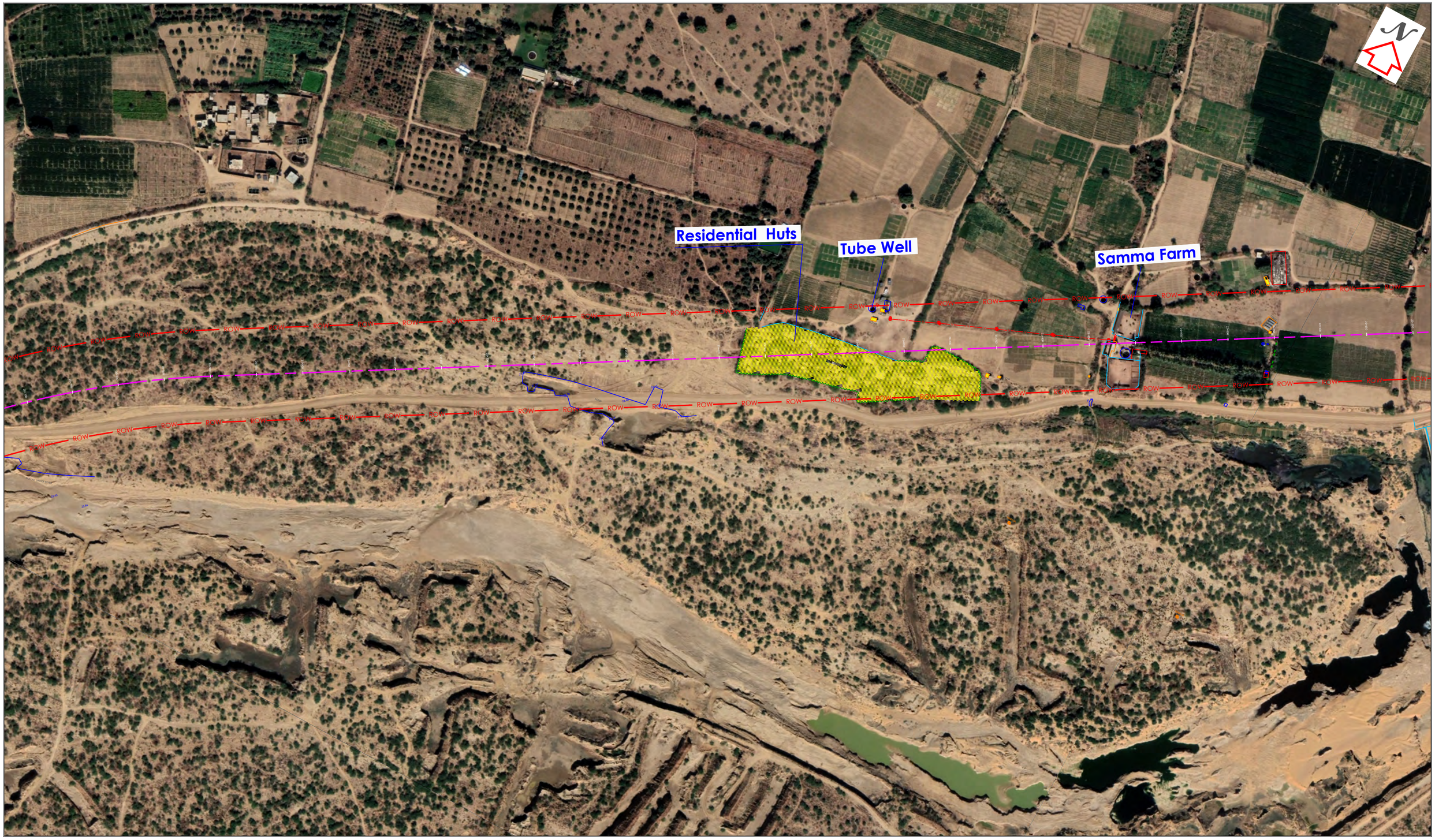
Drawing No. ME-13



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 14 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No. ME-14



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 15 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-15

PREPARED BY

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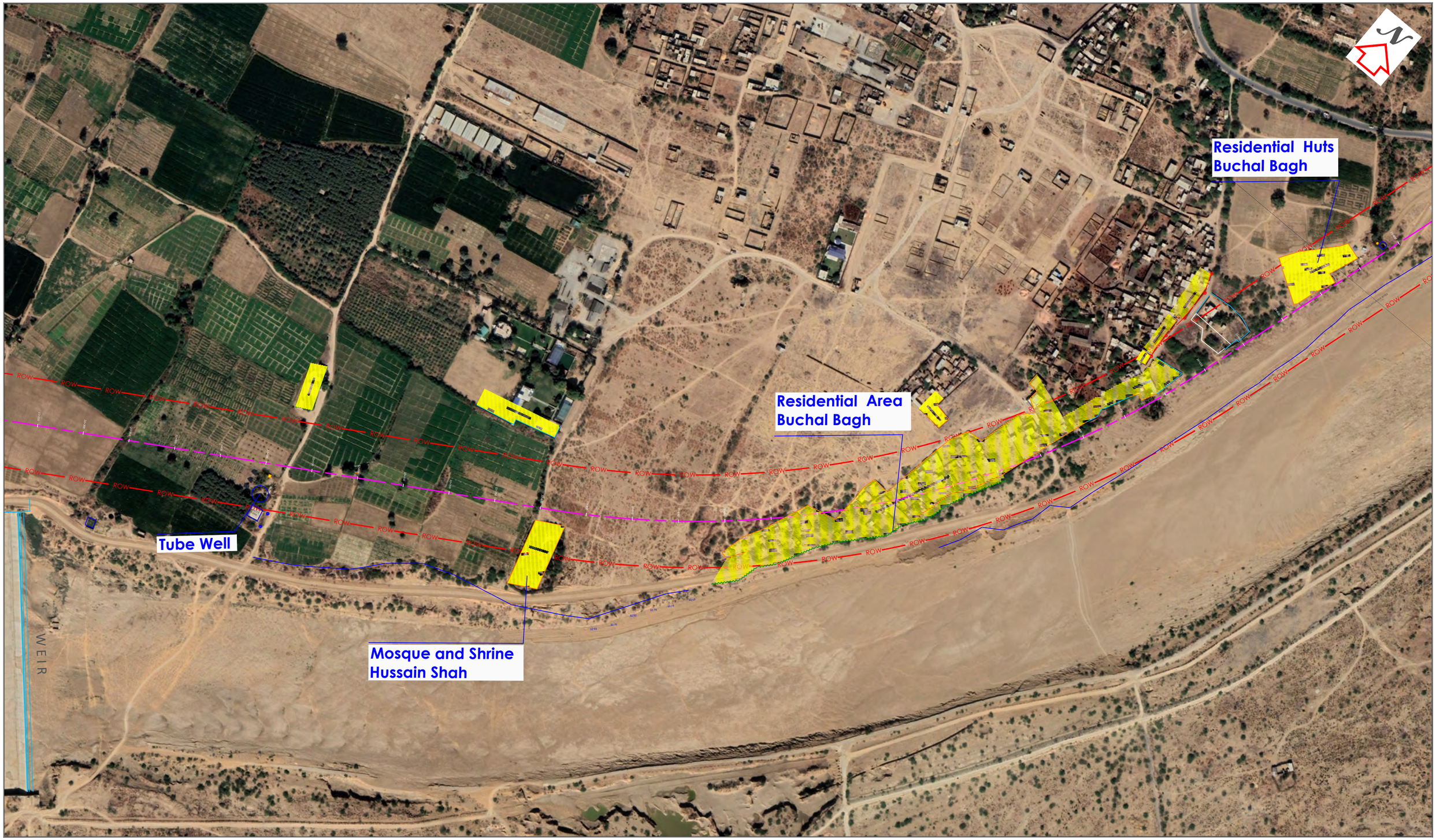
SYED OMAR ARIF

NOTES:-



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED — EMC

CLIENT:- ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 16 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-16

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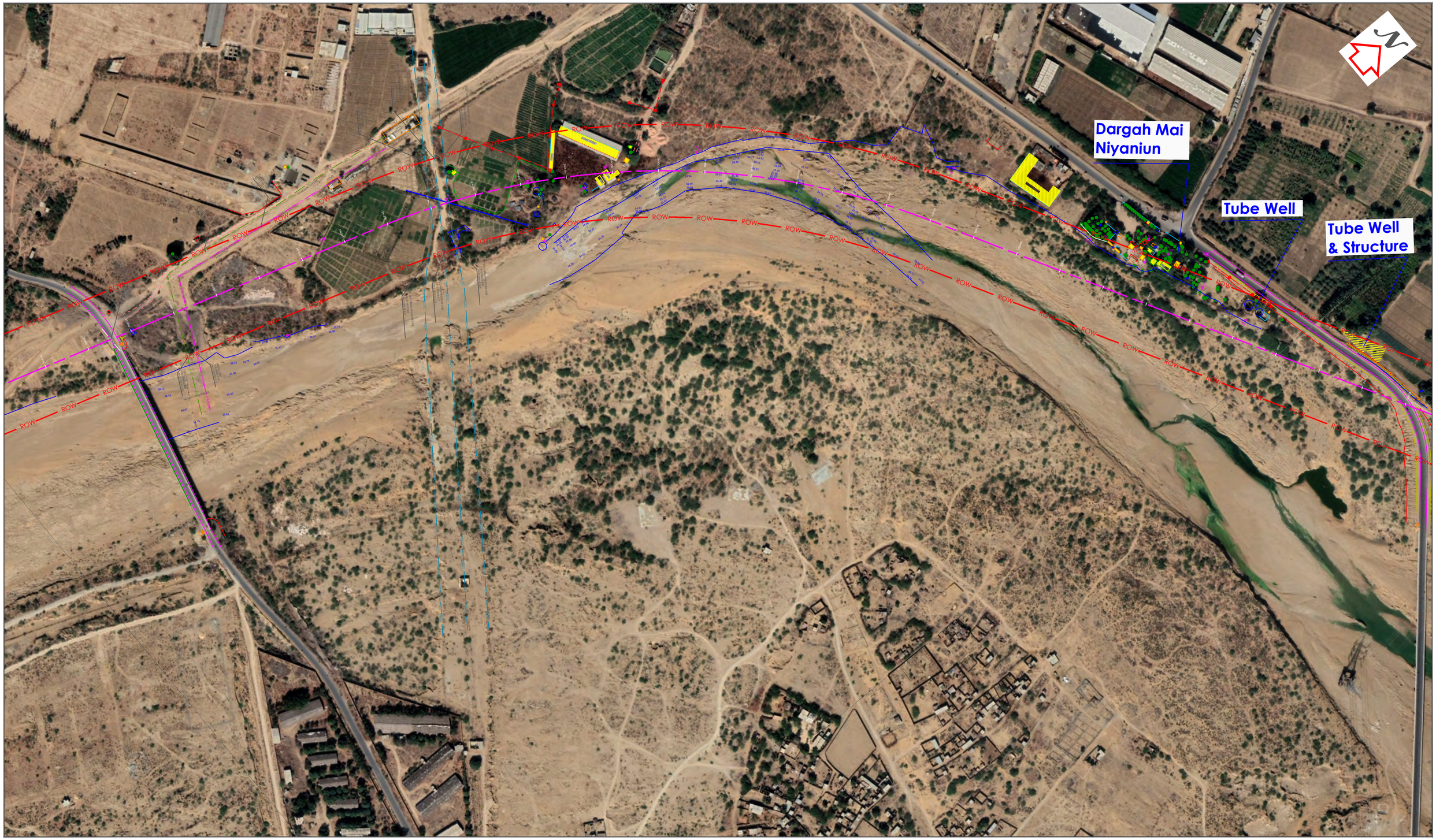
RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 17 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-17

PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

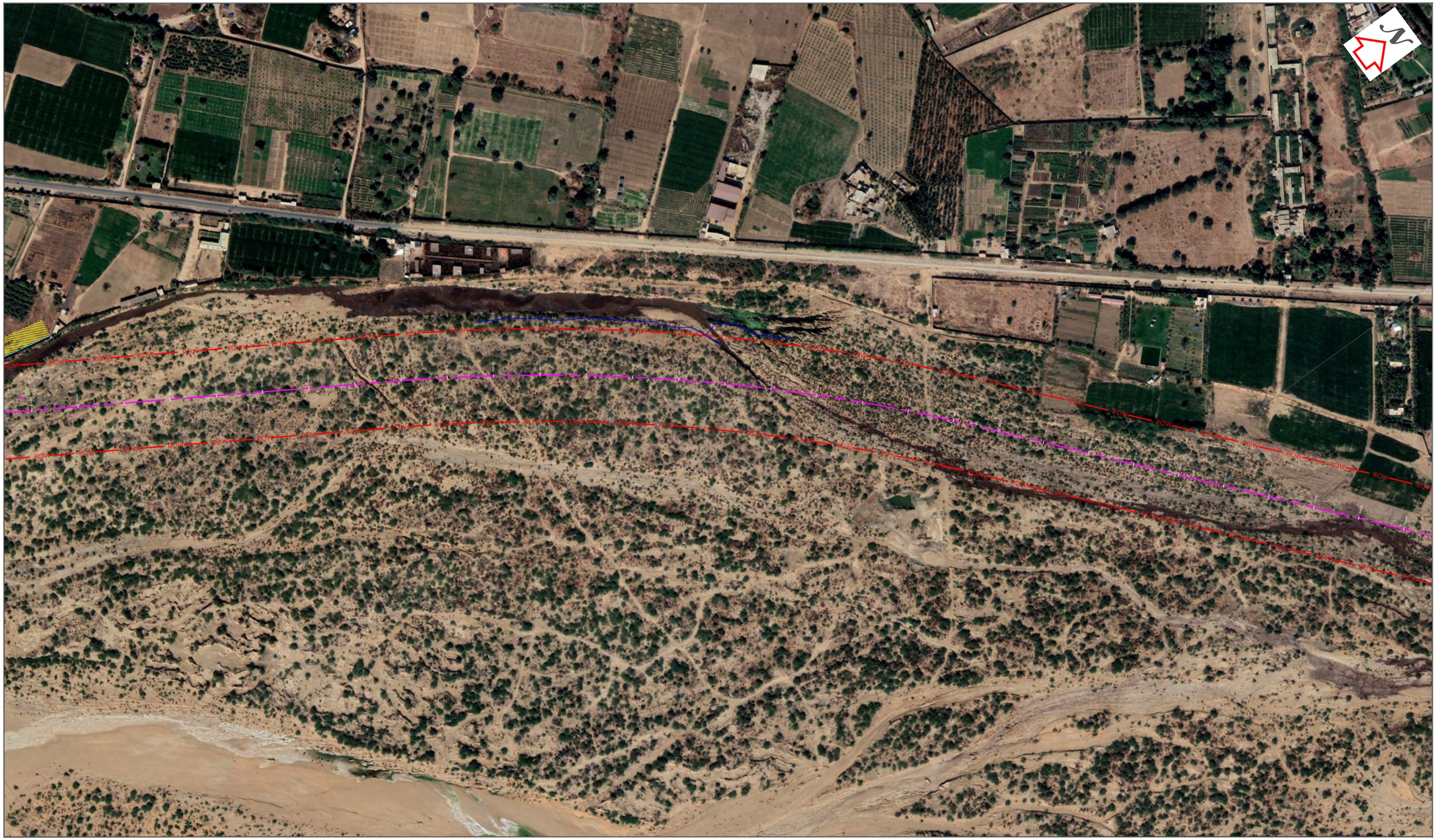
NOTES:-



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 18 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No. ME-18



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 19 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-19

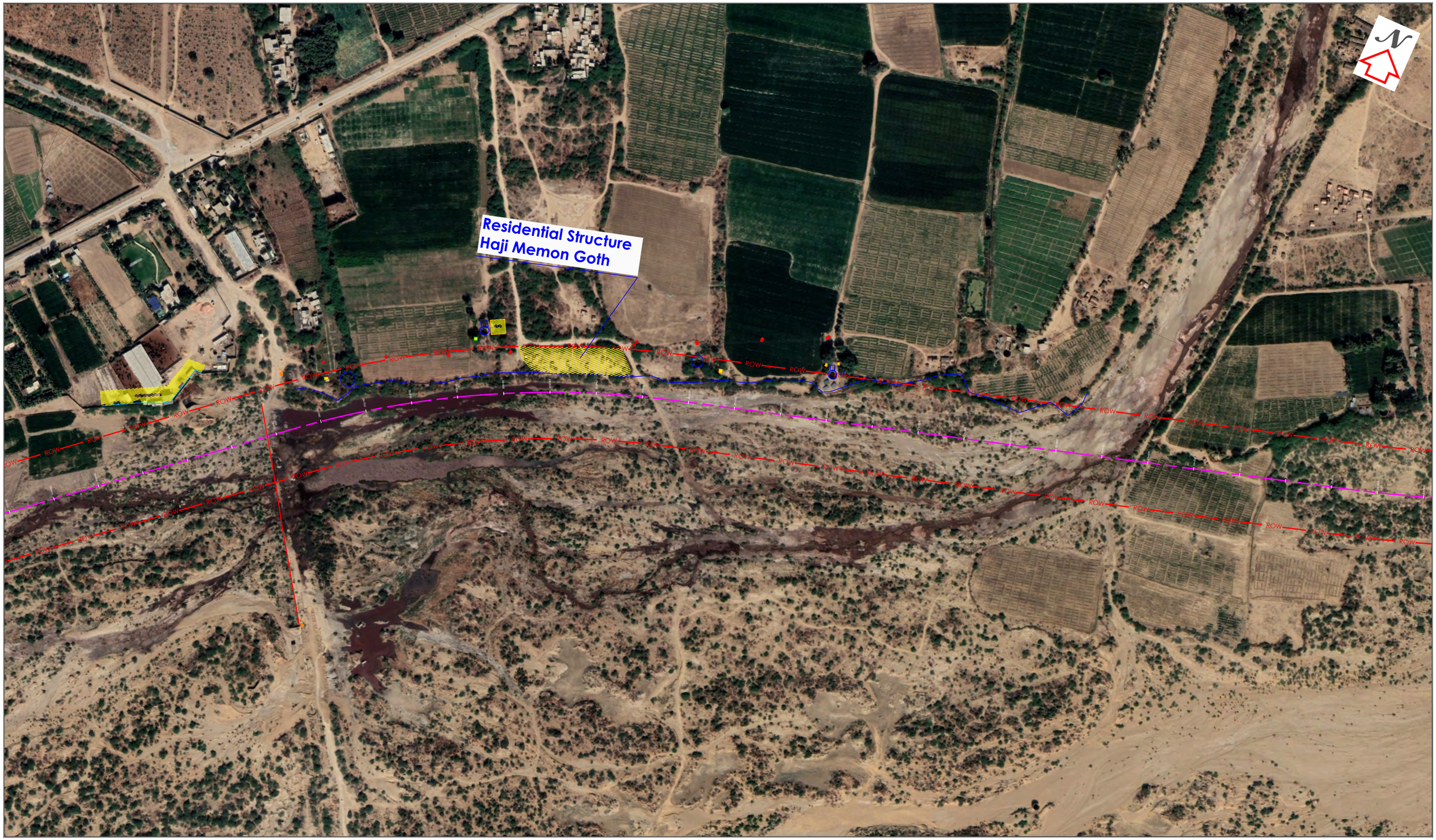
PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

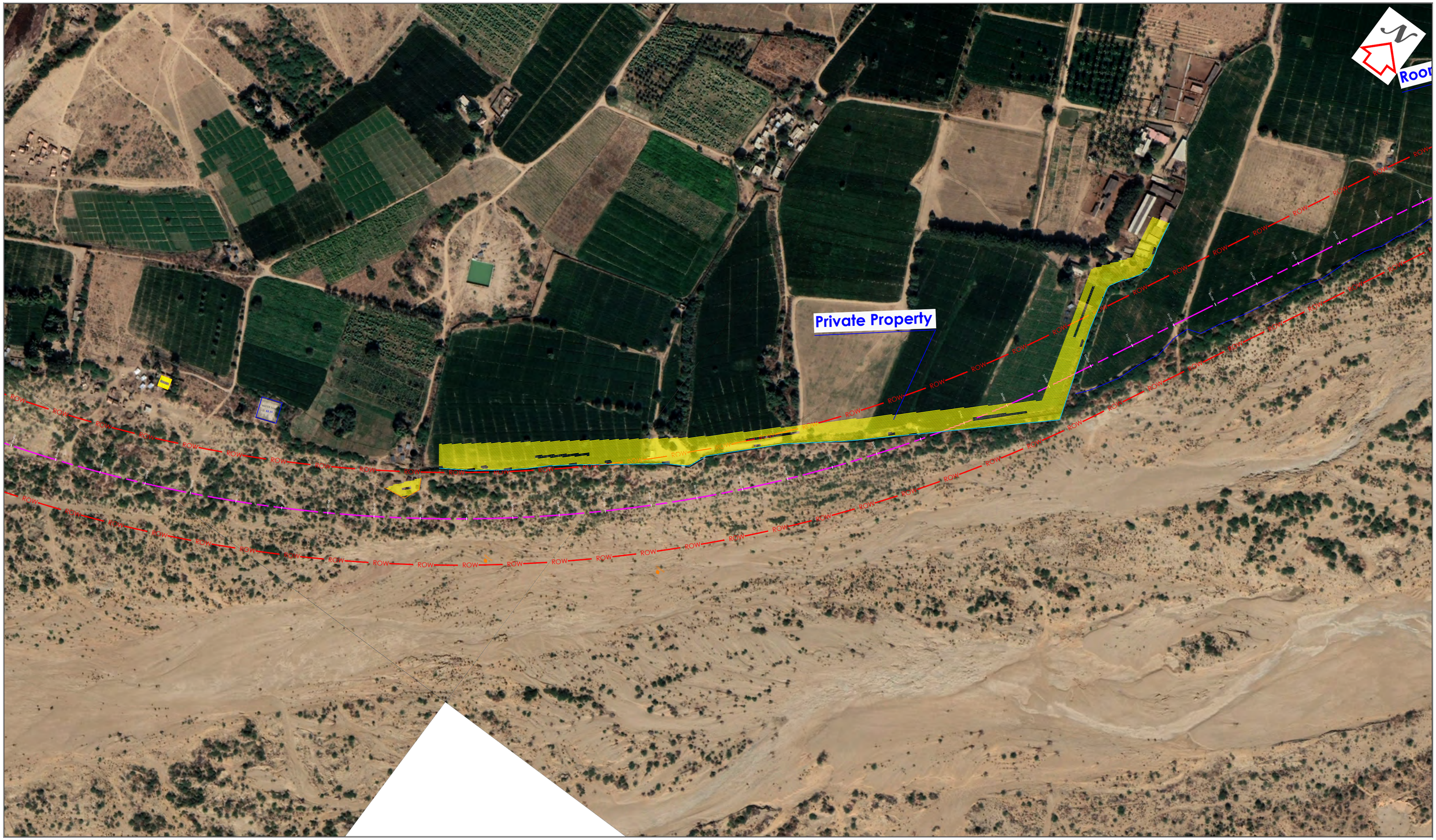
NOTES:-



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 20 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No. ME-20



CONSULTANT:-

CLIENT:-

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 21 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-21

PREPARED BY

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SYED OMAR ARIF

NOTES:-



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EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 22 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-22

PREPARED BY

RAMEEZ UL ISLAM

CHECKED & APPROVED BY

SYED OMAR ARIF

NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 23 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-23

PREPARED BY

RAMEEZ UL ISLAM

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NOTES:-



CONSULTANT:-

EMC PAKISTAN PRIVATE LIMITED
EMC

CLIENT:-

ME

PROJECT:-

ENVIRONMENTAL IMPACT ASSESSMENT

MALIR EXPRESSWAY PROJECT

SHEET TITLE:-

MALIR EXPRESSWAY
TOPOGRAPHIC SURVEY PLAN
(SHEET 24 OF 27)

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No.

ME-24

PREPARED BY

RAMEEZ UL ISLAM

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SYED OMAR ARIF

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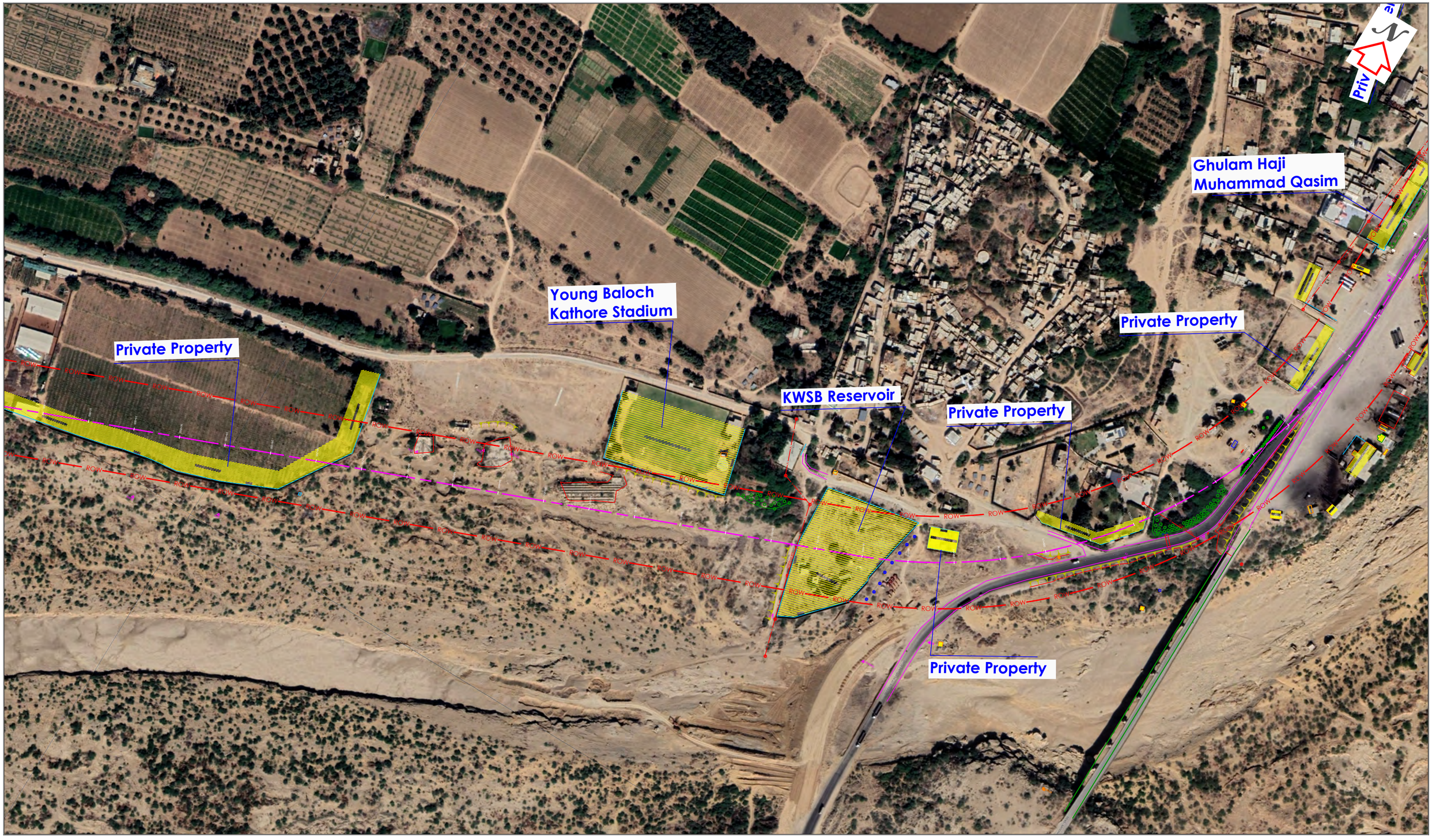
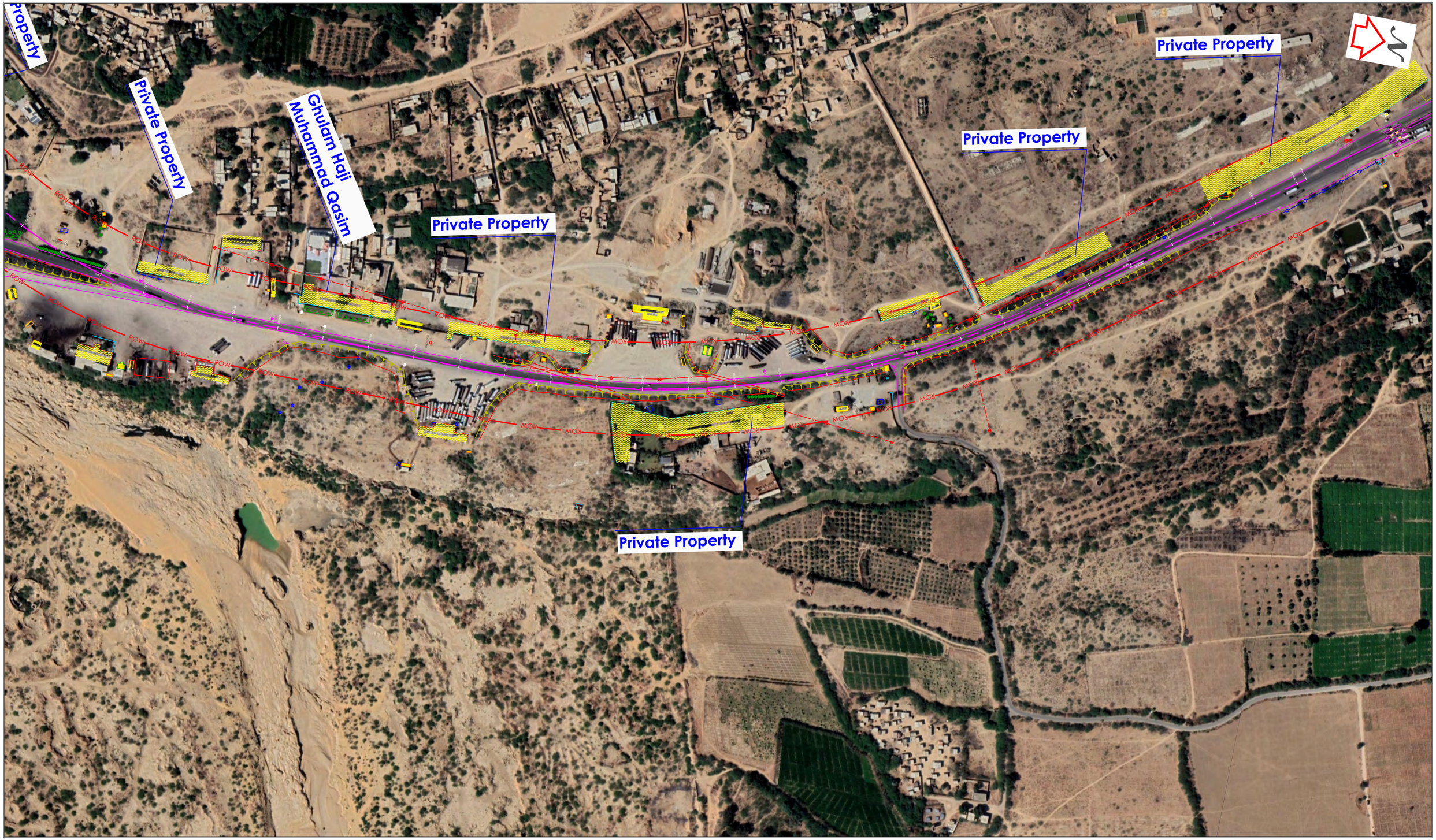


CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 25 OF 27)	PREPARED BY: RAMEEZ UL ISLAM CHECKED & APPROVED BY: SYED OMAR ARIF	NOTES:-
			SHEET SIZE: (A1) / SCALE: 1:500 / DATE: OCTOBER 2021 Drawing No.: ME-25		



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* *MALIR EXPRESSWAY PROJECT*	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 26 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No. ME-26



CONSULTANT:- EMC PAKISTAN PRIVATE LIMITED EMC	CLIENT:- ME	PROJECT:- *ENVIRONMENTAL IMPACT ASSESSMENT* **MALIR EXPRESSWAY PROJECT**	SHEET TITLE:- MALIR EXPRESSWAY TOPOGRAPHIC SURVEY PLAN (SHEET 27 OF 27)	PREPARED BY RAMEEZ UL ISLAM CHECKED & APPROVED BY SYED OMAR ARIF	NOTES:-

SHEET SIZE:	SCALE:	DATE:
(A1)	1:500	OCTOBER 2021

Drawing No. ME-27

Annex VIII – Monitoring Reports

ENVIRONMENTAL MONITORING REPORT 2021

NATIONAL ENGINEERING SERVICES PAKISTAN

HSE Services

Date: 24 December 2020 till 29 December 2020

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HSE SERVICES

1. Executive Summary:

Description of Project

Project Name:	*Environmental Impact Assessment (EIA) Study and Land Acquisition And Resettlement Plan (LARP) Study for Malir Expressway Project (MEX), Karachi Sindh*
Project Type:	Ambient Air Monitoring, Noise Monitoring, Vibration Monitoring, Wastewater/Surface Water & Drinking Water Sampling & analysis at 5 different locations of Malir Expressway Project
Consultant Name:	*M/s HSE Services*
Consultant Address:	*2nd Floor, Mujahid Arcade, Shan Chowrangi, Korangi Industrial Area, Karachi.* *1st Floor, 47th Commercial Area, Cavalry Ground Lahore*
Client Name:	*M/s NESPAK Engineering Services Pakistan*
Client Address:	*1-C, Block N, Model Town Extension, Lahore.*

Consultant's Team Details

Ms. Mariya Gohar	*Coordinator Back Office*
Mr. M. Sibtain	*Field Analyst (Site Team Member 1)*
Mr. Shahryar Fida	*Field Assistant (Site Team Member 2)*
Mr. Kashif Ali	*Field Assistant (Site Team Member 3)*

Monitoring Location

5 Different Locations at Malir Expressway Project

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Document of Reference

SEQS 2016 (Sindh Environmental Quality Standard) has been referred as a guideline to measure the results of monitoring.

Monitoring Findings

A successful environmental monitoring survey has been conducted at prescribed locations and found out that the major part of the monitoring complies with SEQS 2016. However, very few of the deviations were also observed which are discussed in detail in continuous sheets.

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2. Description of Monitoring

2.1 Objective:

HSE Services deployed aforementioned team at prescribed sites on said dates for 24 Hours Continuous Ambient Air Monitoring, 24 Hours Continuous Noise Monitoring, 24 Hours Continuous Vibration Monitoring, Surface Water Sampling, Waste Water Sampling & Drinking Water Sampling & Analysis respectively. The aim of the monitoring is to measure, analyze the effects of monitoring and advise suitable recommendations for better conduct of human health.

2.2 Scope of Work:

Scope of Work (SOW) was set up in accordance with the contract awarded by M/s NESPAK Engineering Services to M/s HSE Services. For Initial understanding of scope of work, consider the following:

- Ambient Air Monitoring of 24 Hours at 5 different locations of Malir Expressway Project. Parameters to be measured are in with accordance of SEQS 2016.
- Noise Monitoring of 24 Hours at 5 different locations of Malir Expressway Project. Noise tested in decibels dB(A).
- Vibration Monitoring of 24 Hours at 5 different locations of Malir Expressway Project. Vibration tested in mm/sec.
- Surface Water, Drinking Water and Waste Water Sampling at site and Analysis of parameters in accordance with SEQS 2016.
- Reporting

2.3 List of Tables:

Table 2.4.1: SEQS 2016 Ambient Air Monitoring
Table 2.4.2 SEQS 2016 Noise Monitoring
Table 2.4.3 SEQS 2016 Drinking Water
Table 2.4.4 SEQS 2016 Waste Water
Table 2.5.3 Instrument Description for Ambient Air, Noise, Vibration & Water

HSE SERVICES

2.4 Environmental Monitoring Guidelines

The following sections provide a thorough understanding on environmental aspects.

2.4.1 Ambient Air Monitoring

Ambient air monitoring is the systematic, long-term assessment of pollutant levels by measuring the quantity and types of certain pollutants in the surrounding, outdoor air. Reasons to monitor ambient could be;

- assess the extent of pollution;
- provide air pollution data in a timely manner;
- support implementation of air quality standards;
- evaluate the effectiveness of emissions control strategies;
- provide information on air quality trends;
- provide data for the evaluation of air quality models

According to SEQS 2016, following parameters are to be measured in 24 hour monitoring in order to ensure pollutant free air;

S. No.	Parameters	SEQS 2016 Limits
1.	Carbon Monoxide CO	5 mg/m$_3$
2.	Sulphur Dioxide SO_2	120 ug/m$_3$
3.	Oxides of Nitrogen as NO	40 ug/m$_3$
4.	Oxides of Nitrogen as NO_2	80 ug/m$_3$
5.	Particulate Matter PM 10	150 ug/m$_3$
6.	Particulate Matter PM 2.5	75 ug/m$_3$
7.	Particulate Matters Respirable SPM	500 ug/m$_3$
8.	Lead (Pb)	1.5 ug/m$_3$
9.	Ozone O3	130 ug/m$_3$

Table 2.4.1

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2.4.2 Noise Monitoring

Noise pollution adversely affects the lives of millions of people. Problems related to noise include stress related illnesses, high blood pressure, speech interference, hearing loss, sleep disruption, and lost productivity. Noise Induced Hearing Loss (NIHL) is the most common and often discussed health effect.

According to SEQS 2016, Noisy areas need to be monitored and it is to be ensured that controls are applied in order to maintain sound within below prescribed limits;

SEQS Limits	Industrial Area	Residential Area
Day Time Noise	75	55
Night Time Noise	65	45
Day Time Hours: 6:00 am to 10:00 pm **Night Time Hours: 10:00 pm to 6:00 am**		

Table 2.4.2

2.4.3 Drinking Water Analysis

Safe and readily available water is important for public health, whether it is used for drinking, domestic use, food production or recreational purposes. Contaminated water and poor sanitation are linked to transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio. Absent, inadequate, or inappropriately managed water and sanitation services expose individuals to preventable health risks.

In order to prevent diseases and mitigate human health risks, SEQS 2016 regulates following safe drinking water limits;

S. No.	Parameters	SEQS Limits
1.	pH @ 25°C	6.5-8.5
2.	Total Dissolved Solids	<1000 (mg/L)
3.	Phenolic compound	0.002 (mg/L)
4.	Chloride	<250 (mg/L)

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5.	Total Hardness as CaCO3	<500 (mg/L)
6.	Aluminium	0.2 (mg/L)
7.	Residual Chlorine	0.2-0.5
8.	Antimony	<0.005 (mg/L)
9.	Arsenic	0.05 (mg/L)
10.	Taste	Non-Objectionable
11.	Odour	Non-Objectionable
12.	Barium	0.7 (mg/L)
13.	Boron	0.3 (mg/L)
14.	Copper	0.2 (mg/L)
15.	Lead	<0.05 (mg/L)
16.	Mercury	<0.001 (mg/L)
17.	Nickel	0.02 (mg/L)
18.	Manganese	0.5 (mg/L)
19.	Zinc	<5 (mg/L)
20.	Selenium	0.01 (mg/L)
21.	Cyanide	0.05 (mg/L)
22.	Chromium	<0.05 (mg/L)
23.	Fluoride	1.5 (mg/L)
24.	Cadmium	0.01 (mg/L)
25.	Nitrate	0.5 (mg/L)
26.	Nitrite	3 (mg/L)
27.	Color	<15 TCU
28.	Turbidity	<5 NTU
29.	Total Coliform	0/100 ml
30.	Escherichia Coliform	0/100 ml
31.	Pesticides	0.15 (mg/L)

Table 2.4.3

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2.4.4 Wastewater Analysis

Wastewater refers to treated water or untreated water that flows out of a treatment plant, sewer, or industrial outfall. Generally, it refers to wastes discharged into surface waters. Effluent is generally considered to be water pollution such as the outflow from a sewage treatment facility or the wastewater discharge from industrial facilities or domestically discharged water. In order to restrict communities for safe disposal of effluent into surface water, SEQS 2016 have stated following limits;

S. No	Parameters	SEQS Limits
1.	pH @ 25°C	6 – 9
2.	Biological Oxygen Demand	80 (mg/L)
3.	Chemical Oxygen Demand	150 (mg/L)
4.	Total Dissolved Solids	3500 (mg/L)
5.	Total Suspended Solids	200 (mg/L)
6.	Oil & Grease	10 (mg/L)
7.	Chloride	1000 (mg/L)
8.	Phenolic compound	0.1 (mg/L)
9.	Fluoride	10 (mg/L)
10.	Anionic Detergent	20 (mg/L)
11.	Selenium	0.5 (mg/L)
12.	Sulphide	1 (mg/L)
13.	Ammonia	40 (mg/L)
14.	Cadmium	0.1 (mg/L)
15.	Chromium	1 (mg/L)
16.	Copper	1 (mg/L)
17.	Lead	0.5 (mg/L)
18.	Mercury	0.01 (mg/L)
19.	Nickel	1 (mg/L)
20.	Silver	1 (mg/L)
21.	Zinc	5 (mg/L)
22.	Total Iron	8 (mg/L)

HSE SERVICES

23.	Manganese	1.5
24.	Boron	6 (mg/L)
25.	Sulphate	600 (mg/L)
26.	Arsenic	1 (mg/L)
27.	Chlorine	1 (mg/L)
28.	Total Toxic Metals	2 (mg/L)
29.	Barium	1.5
30.	Cyanide	1
31.	Temperature	40± ≤03°C

Table 2.4.4

2.5 Methodology

2.5.1 Water Sampling Methodology:

Following methodology was adopted for water sampling and analysis:

2.5.1.1 Sample Collection

The water samples were collected from identified sampling points. The sampling was carried out in accordance to the Standard Operating Procedures (SOP) based on the recognized methods of United State Environmental Protection Agency (USEPA), World Health Organization (WHO) and American Public Health Association (APHA) for water sampling and analysis.

2.5.1.2 Preservation

Preservation is important in order to minimize the changes in the sample. The collected water samples were preserved in appropriate containers as per APHA Guidelines, the method of which is given as under:-
Samples were preserved below pH -2 by addition of sulphuric acid and stored below 4 °C.

2.5.1.3 Sample Identification and Chain of Custody

The collected samples were labeled and assigned a unique sample identification number, along with sampling date and time of collection. All the relevant information (sample location, time of collection, sample identification, temperature, collected by, preservation techniques etc.) was recorded immediately on the Chain of Custody form signed by HSE Services field Analyst.

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2.5.1.4 Transportation

Ice box filled with ice, maintained at temperature 4°C ±5°C was used for transporting the sample from the collection site to the environmental laboratory.

2.5.2 Monitoring & Sampling Coordinates:

The locations where measurements were performed were selected based on the agreed TORs with client and which are as follows;

Ambient Air, Vibration and Noise Monitoring Sites & Date

- Site # 1 – *AN3 MEX*
  Monitoring Dates: *24 Dec 2020 Till 25 Dec 2020*
  Coordinates: *Longitude 67.2031* *Latitude 24.8670*
- Site # 2 – *AN2 MEX*
  Monitoring Dates: *25 Dec 2020 Till 26 Dec 2020*
  Coordinates: *Longitude 67.1302* *Latitude 24.8704*
- Site # 3 – *AN1 MEX*
  Monitoring Dates: *26 Dec 2020 Till 27 Dec 2020*
  Coordinates: *Longitude 67.0870* *Latitude 24.8320*
- Site # 4 – *AN4 MEX*
  Monitoring Dates: *27 Dec 2020 Till 28 Dec 2020*
  Coordinates: *Longitude 67.2639* *Latitude 25. 24.9121*
- Site # 5 – *AN5 MEX*
  Monitoring Dates: *28 Dec 2020 Till 29 Dec 2020*
  Coordinates: *Longitude 67.3575* *Latitude 25.0039*

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Water Sampling Locations

- Surface Water # 01 – *SW1- MEX, 24°49'57.66"N, 67°5'21.44"E*
- Drinking Water # 01 – *GW-1, MEX, 24° 52'8.33"N, 67° 13'11.08"E*
- Surface Water # 02 – *SW-2 MEX, 24°53'0.62"N, 67° 14'9.3"E*
- Drinking Water # 02 – *GW-2 MEX, 24°58'3.65"N, 67° 19'24.15"E*
- Surface Water # 03 – *S W-3 MEX , 24°59'19.99"N, 67°21'39.42"E*

2.5.3 Monitoring Equipment:

The measurements were performed by using different equipment. The details of the equipment are as follows;

For Ambient Air Monitoring & Noise

S. No	Parameters	Equipment
1.	CO	Testo 315-3 for CO Detection
2.	NO	Ecotech Analyzer
3.	NO2	Ecotech Analyzer
4.	SO2	Ecotech Analyzer
5.	PM 10/ PM 2.5/ SPM	Laser Particle Multifunctional Detector
6.	O3	Ecotech Analyzer
7.	Lead	Lead Assembly & Lab Analysis on AAS
8.	Noise	Extech Noise Meter
9.	Vibration	Benetech Vibration Meter

Table 2.5.3

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For Water Sampling & Analysis

S. No	Parameters	Equipment
1.	Drinking Water SEQS 2016	Site Sampling and Lab Analysis as per *APHA & **ASTM Methods
2.	Waste Water SEQS 2016	Site Sampling and Lab Analysis as per *APHA & **ASTM Methods
3.	Surface Water SEQS 2016	Site Sampling and Lab Analysis as per *APHA & **ASTM Methods
*APHA stands for American Public Health Association **American Society for Testing & Materials		

Table 2.5.4

2.5.4 Monitoring Parameters:

Refer **Table 2.4.1 – Table 2.4.4**

2.5.5 Monitoring Procedure:

Step 1

- Awarding of contract
- Coordination and confirmation of monitoring schedule
- Arrangement and deployment of site team at site

Step 2

- 24 hours continuous monitoring of ambient air at each point and measurement taken on average basis. Equipment were set up at mutually agreed point (as according to the prescribed coordinates) and continuous monitoring of air quality was conducted without any interruption.
- 24 hours continuous monitoring of noise of surroundings and measurement taken on average basis.
- 24 hours continuous monitoring of Vibration and measurement taken on average basis.
- Water samples collected from site and preserved samples in ice boxes to maintain the temperature until delivery to laboratory.

Step 3

- Reporting

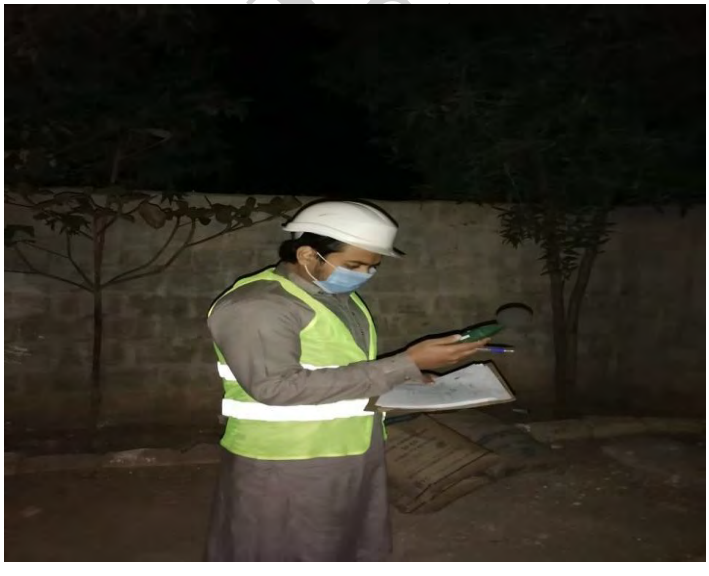
Air Monitoring and Water sampling at Various Points













ENVIRONMENTAL TESTING LABORATORY

TEST REPORT

Job No.	HSE/LHE/01-1/2021	**Date of Issuance**	06-01-2021
Sample Information			
Commodity	Ambient Air Quality Monitoring	**Reference No.**	HSE/LHE/IND/01/21
Location	AN3 MEX	**Sampling Duration**	24 Hours
Co-ordinates	24.8670, 67.2031	**Date of Analysis**	24-12-2020 till 25-12-2020
Client/Establishment			
Name	**National Engineering Services Pakistan Pvt. Ltd**		
Address & Location	**NESPAK House 1-C, Block-N, Model Town Extension, Lahore**		

TEST RESULTS

Parameter	Averaging Time		SEQS	Unit	*Avg. Conc.	Methodology
Carbon Monoxide (CO)	8 h		**5**	mg/m^3	4.69	*NDIR
Sulfur Dioxide (SO_2)	24 h		**120**	$\mu g/m^3$	7.87	UV Fluorescence
Nitrogen Dioxide (NO_2)	24 h		**80**	$\mu g/m^3$	119.85	Chemiluminescence
Nitric Oxide (NO)	24 h		**40**	$\mu g/m^3$	18.75	Chemiluminescence
Oxides of Nitrogen (NOx)	24 h		**120**	$\mu g/m^3$	138.6	Chemiluminescence
Particulate Matter (PM_{10})	24 h		**150**	$\mu g/m^3$	72.62	Beta-Ray Absorption
Particulate Matter ($PM_{2.5}$)	24 h		**75**	$\mu g/m^3$	65.29	Beta-Ray Absorption
Suspended Particulates (SPM)	24 h		**500**	$\mu g/m^3$	349	Gravimetric Sampling
Ozone (O_3)	1 h		**130**	$\mu g/m^3$	20.98	Non-Dispersive UV Absorption Method
Lead	24 h		**1.5**	$\mu g/Nm^3$	0.58	AAS Method
Noise	Day-time	16:00 h	**65**	dB (A)	52.35	ASTM E-1124
	Night-time	8:00 h	**55**		51.69	ASTM E-1124
Vibration*	24 h		**--**	mm/s	0.25	ISO 2954

For Detailed Monitoring Results Please see **Log Table 2.0*

HSE SERVICE

24 Hour Monitoring Data for Ambient Air

Log Table 2.0

Sr. No.	Time	CO	NO	NO_2	NO_x	SO_2	O_3	$PM_{2.5}$	PM_{10}	SPM	Lead	Noise	Vibration
		mg/m^3	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	dB(A)	mm/sec
1.	9:00	3.5	18	122	140	5.54	--	50	54	318		51	0
2.	10:00	4	16.7	95.1	111.8	5.67	--	49	53	312		53.1	0
3.	11:00	3.5	14.4	56.1	70.5	5.72	--	38	42	302		53	0.1
4.	12:00	4	15.5	72	87.5	5.89	--	36	40	299		52.1	0.2
5.	13:00	4	18.8	111.8	130.6	6.82	20.98	35	39	289		52.4	0.8
6.	14:00	8.5	16.3	87	103.3	7.24	--	31	34	285		53.1	0.3
7.	15:00	7	16.68	95.07	111.75	5.72	--	49	54	303		52	0.3
8.	16:00	3	17.1	101.04	118.14	7.34	--	44	51	306		51.6	0.5
9.	17:00	--	15.7	80.3	96	8.75	--	48	53	315		52.7	0.5
10.	18:00	--	22.35	178.9	201.25	8.41	--	57	62	318		51.4	0.3
11.	19:00	--	22.35	178.99	201.34	8.42	--	59	66	326		52.6	0.3
12.	20:00	--	21.14	154	175.14	9.1	--	110	125	412	0.58	53.4	0.2
13.	21:00	--	22.13	178.92	201.05	9.01	--	109	124	410		52.8	0.1
14.	22:00	--	21.15	154	175.15	9.08	--	111	124	416		55.4	0.2
15.	23:00	--	16.1	60.1	76.2	9.2	--	89	99	407		53.9	0.2
16.	00:00	--	19.11	94.1	113.21	9.37	--	90	100	408		51.6	0.3
17.	1:00	--	18.11	97.3	115.41	9.4	--	63	70	352		51.1	0.1
18.	2:00	--	20.03	144.1	164.13	9.5	--	62	69	354		52	0.3
19.	3:00	--	21.15	153.05	174.2	9	--	64	71	341		52.4	0.3
20.	4:00	--	21.17	150.68	171.85	9.06	--	71	79	369		50.9	0.2
21.	5:00	--	21.19	151.6	172.79	9.07	--	73	80	387		50.4	0.2
22.	6:00	--	21.25	152.9	174.15	9.78	--	70	77	370		51.2	0.4
23.	7:00	--	16.6	98.6	115.2	6	--	79	88	387		50.4	0.2
24.	8:00	--	16.92	108.7	125.62	5.7	--	80	89	390		50.6	0.1

HSE SERVICES

ENVIRONMENTAL TESTING LABORATORY

TEST REPORT

Job No.	HSE/LHE/01-1/2021	**Date of Issuance**	06-01-2021
Sample Information			
Commodity	Ambient Air Quality Monitoring	**Reference No.**	HSE/LHE/IND/01-A/21
Location	AN2 MEX	**Sampling Duration**	24 Hours
Co-ordinates	24.8704, 67.1302	**Date of Analysis**	25-12-2020 till 26-12-2020
Client/Establishment			
Name	**National Engineering Services Pakistan Pvt. Ltd**		
Address & Location	**NESPAK House 1-C, Block-N, Model Town Extension, Lahore**		

TEST RESULTS

Parameter	Averaging Time		SEQS	Unit	*Avg. Conc.	Methodology
Carbon Monoxide (CO)	8 h		**5**	mg/m^3	0.625	*NDIR
Sulfur Dioxide (SO_2)	24 h		**120**	µg/m^3	8.31	UV Fluorescence
Nitrogen Dioxide (NO_2)	24 h		**80**	µg/m^3	27.43	Chemiluminescence
Nitric Oxide (NO)	24 h		**40**	µg/m^3	14.48	Chemiluminescence
Oxides of Nitrogen (NOx)	24 h		**120**	µg/m^3	41.9	Chemiluminescence
Particulate Matter (PM_{10})	24 h		**150**	µg/m^3	65.87	Beta-Ray Absorption
Particulate Matter ($PM_{2.5}$)	24 h		**75**	µg/m^3	58.92	Beta-Ray Absorption
Suspended Particulates (SPM)	24 h		**500**	µg/m^3	294.37	Gravimetric Sampling
Ozone (O_3)	1 h		**130**	µg/m^3	21.29	Non-Dispersive UV Absorption Method
Lead	24 h		**1.5**	µg/Nm^3	0.59	AAS Method
Noise	Day-time	16:00 h	**65**	dB (A)	48.08	ASTM E-1124
	Night-time	8:00 h	**55**		44.91	ASTM E-1124
Vibration*	24 h		**--**	mm/s	0.27	ISO 2954

For Detailed Monitoring Results Please see **Log Table 4.0*

HSE SERVICES

24 Hour Monitoring Data for Ambient Air

Log Table 4.0

Sr. No.	Time	CO	NO	NO_2	NO_x	SO_2	O_3	$PM_{2.5}$	PM_{10}	SPM	Lead	Noise	Vibration
		mg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	dB(A)	mm/sec
1.	13:30	0.5	17.52	29.83	47.35	6.76	--	36	40	232	0.59	51.1	0.2
2.	14:30	0	18.54	29.9	48.44	6.86	--	30	33	212		51.3	0.2
3.	15:30	0.5	16.52	31.43	47.95	6.87	--	33	36	219		49.9	0.3
4.	16:30	--	12.3	2.32	14.62	6.86	--	68	76	313		50.1	0.1
5.	17:30	--	12.5	32.79	45.29	8.21	--	66	75	308		48	0.3
6.	18:30	--	18.53	42.39	60.92	8.5	--	52	58	298		46	0.3
7.	19:30	--	12.63	42.98	55.61	8.57	--	49	54	297		44	0.1
8.	20:30	--	12.51	23.32	35.83	9.4	--	62	69	301		49.1	0.2
9.	21:30	--	16.64	42.92	59.56	9.5	--	63	70	304		48	0.6
10.	22:30	--	12.58	31.55	44.13	7.17	--	84	94	341		45.4	0.5
11.	23:30	--	12.57	32.24	44.81	7.2	--	70	78	317		44	0.3
12.	00:30	--	12.43	20.54	32.97	9.1	--	83	98	340		45	0.4
13.	01:30	--	13.85	17.1	30.95	8.8	--	70	78	312		45.9	0.2
14.	02:30	--	13.21	14.03	27.24	8.25	--	76	85	321		44.7	0.3
15.	03:30	--	14.2	14.2	28.4	8.11	--	43	48	276		45.1	0.3
16.	04:30	--	12.1	16.4	28.5	8	--	44	49	279		44.3	0.7
17.	05:30	--	12.6	18.32	30.92	8.11	--	43	48	271		44.9	0.1
18.	06:30	--	12.2	19.43	31.63	8.56	--	68	76	308		45.3	0.2
19.	7:30	--	13.2	23.56	36.76	8.84	--	66	73	305		45.8	0.3
20.	08:30	0.5	14.7	28.72	43.42	9.02	--	73	81	314		44.6	0.2
21.	09:30	0.5	16.5	28.98	45.48	9.03	--	71	79	313		47.2	0.1
22.	10:30	1	16.7	43.41	60.11	9.13	--	69	77	309		49.1	0.2
23.	11:30	1.5	17.3	36.74	54.04	9.32	--	50	56	292		50.1	0.3
24.	12:30	0.5	15.6	35.2	50.8	9.32	21.29	45	50	283		49.7	0.2

HSE SERVICES

ENVIRONMENTAL TESTING LABORATORY

TEST REPORT

Job No.	HSE/LHE/01-1/2021	**Date of Issuance**	06-01-2021
Sample Information			
Commodity	Ambient Air Quality Monitoring	**Reference No.**	HSE/LHE/IND/01-B/21
Location	AN1 MEX	**Sampling Duration**	24 Hours
Co-ordinates	24.8320, 67.0870	**Date of Analysis**	26-12-2020 till 27-12-2020
Client/Establishment			
Name	**National Engineering Services Pakistan Pvt. Ltd**		
Address & Location	**NESPAK House 1-C, Block-N, Model Town Extension, Lahore**		

TEST RESULTS

Parameter	Averaging Time	SEQS	Unit	*Avg. Conc.	Methodology
Carbon Monoxide (CO)	8 h	**5**	mg/m^3	0.69	*NDIR
Sulfur Dioxide (SO_2)	24 h	**120**	$\mu g/m^3$	7.98	UV Fluorescence
Nitrogen Dioxide (NO_2)	24 h	**80**	$\mu g/m^3$	30.47	Chemiluminescence
Nitric Oxide (NO)	24 h	**40**	$\mu g/m^3$	14.3	Chemiluminescence
Oxides of Nitrogen (NOx)	24 h	**120**	$\mu g/m^3$	44.77	Chemiluminescence
Particulate Matter (PM_{10})	24 h	**150**	$\mu g/m^3$	55.87	Beta-Ray Absorption
Particulate Matter ($PM_{2.5}$)	24 h	**75**	$\mu g/m^3$	36.67	Beta-Ray Absorption
Suspended Particulates (SPM)	24 h	**500**	$\mu g/m^3$	244.62	Gravimetric Sampling
Ozone (O_3)	1 h	**130**	$\mu g/m^3$	23.4	Non-Dispersive UV Absorption Method
Lead	24 h	**1.5**	$\mu g/Nm^3$	0.21	AAS Method
Noise	Day-time 16:00 h	**65**	dB (A)	46.74	ASTM E-1124
	Night-time 8:00 h	**55**		40.3	ASTM E-1124
Vibration*	24 h	**--**	mm/s	0.23	ISO 2954

For Detailed Monitoring Results Please see **Log Table 6.0*

HSE SERVICES

24 Hour Monitoring Data for Ambient Air

Log Table 6.0

Sr. No.	Time	CO	NO	NO_2	NO_x	SO_2	O_3	$PM_{2.5}$	PM_{10}	SPM	Lead	Noise	Vibration
		mg/m^3	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	dB(A)	mm/sec
1.	14:00	1.5	12.73	23.18	35.91	10.25	--	39	43	243		50.9	0.2
2.	15:00	1	13.38	24.2	37.58	10.24	--	36	40	231		50.1	0.3
3.	16:00	0.5	12.79	24.7	37.49	10.25	--	36	36	228		49.9	0.1
4.	17:00	--	12.78	24.98	37.76	12.2	--	35	39	227		49	0.4
5.	18:00	--	12.5	25.42	37.92	7.43	--	38	42	239		50.1	0.2
6.	19:00	--	13.7	32.34	46.04	7.7	--	48	53	278		49.3	0.1
7.	20:00	--	12.9	38.47	51.37	7.31	--	49	54	281		50	0.1
8.	21:00	--	15.72	23.34	39.06	9.25	--	37	59	238		49.5	0.2
9.	22:00	--	14.24	24.99	39.23	9.5	--	39	55	251		50.1	0.2
10.	23:00	--	13.36	25.42	38.78	6.1	--	28	45	212		41.3	0.4
11.	00:00	--	16.2	27.35	43.55	7.27	--	33	49	231		38.5	0.2
12.	1:00	--	12.1	36.51	48.61	6.33	--	29	56	222	0.21	30.1	0.2
13.	2:00	--	12.92	39.63	52.55	6.45	--	31	59	234		32.3	0.1
14.	3:00	--	14.4	35.8	50.2	6.76	--	39	65	258		42.5	0.3
15.	4:00	--	17.2	39.9	57.1	7.8	--	41	67	248		43.1	0.3
16.	5:00	--	13.33	41.9	55.23	7.84	--	30	71	248		52.5	0.4
17.	6:00	--	12.76	35.86	48.62	6.9	--	35	67	244		42.1	0.2
18.	7:00	--	14.47	38.9	53.37	7.9	--	40	61	258		40.1	0.2
19.	8:00	--	12.31	29.8	42.11	6.03	--	45	77	288		45.3	0.1
20.	9:00	0.5	17.1	35.8	52.9	7.11	--	41	68	250		39.5	0
21.	10:00	0	18.2	40.7	58.9	7.36	--	38	63	251		37.1	0.1
22.	11:00	0.5	16.21	22.8	39.01	8.37	--	31	78	258		42.5	0.4
23.	12:00	0.5	18.4	29.85	48.25	8.43	--	39	69	255		47.1	0.4
24.	13:00	1	13.62	9.55	23.17	6.67	23.4	23	25	198		47.3	0.3

HSE SERVICES

ENVIRONMENTAL TESTING LABORATORY

TEST REPORT

Job No.	HSE/LHE/01-1/2021	**Date of Issuance**	06-01-2021
Sample Information			
Commodity	Ambient Air Quality Monitoring	**Reference No.**	HSE/LHE/IND/01-C/21
Location	AN4 MEX	**Sampling Duration**	24 Hours
Co-ordinates	24.9121, 67.2639	**Date of Analysis**	27-12-2020 till 28-12-2020
Client/Establishment			
Name	**National Engineering Services Pakistan Pvt. Ltd**		
Address & Location	**NESPAK House 1-C, Block-N, Model Town Extension, Lahore**		

TEST RESULTS

Parameter	Averaging Time	SEQS	Unit	*Avg. Conc.	Methodology
Carbon Monoxide (CO)	8 h	**5**	mg/m^3	0.86	*NDIR
Sulfur Dioxide (SO_2)	24 h	**120**	$\mu g/m^3$	10.81	UV Fluorescence
Nitrogen Dioxide (NO_2)	24 h	**80**	$\mu g/m^3$	20.49	Chemiluminescence
Nitric Oxide (NO)	24 h	**40**	$\mu g/m^3$	13.62	Chemiluminescence
Oxides of Nitrogen (NOx)	24 h	**120**	$\mu g/m^3$	34.11	Chemiluminescence
Particulate Matter (PM_{10})	24 h	**150**	$\mu g/m^3$	62.67	Beta-Ray Absorption
Particulate Matter ($PM_{2.5}$)	24 h	**75**	$\mu g/m^3$	56.21	Beta-Ray Absorption
Suspended Particulates (SPM)	24 h	**500**	$\mu g/m^3$	282.17	Gravimetric Sampling
Ozone (O_3)	1 h	**130**	$\mu g/m^3$	22.7	Non-Dispersive UV Absorption Method
Lead	24 h	**1.5**	$\mu g/Nm^3$	0.25	AAS Method
Noise	Day-time 16:00 h	**65**	dB (A)	47.58	ASTM E-1124
	Night-time 8:00 h	**55**		46.65	ASTM E-1124
Vibration*	24 h	--	mm/s	0.24	ISO 2954

For Detailed Monitoring Results Please see **Log Table 8.0*

HSE SERVICES

24 Hour Monitoring Data for Ambient Air

Log Table 8.0

Sr. No.	Time	CO	NO	NO_2	NO_x	SO_2	O_3	$PM_{2.5}$	PM_{10}	SPM	Lead	Noise	Vibration
		mg/m^3	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	dB(A)	mm/sec
1.	17:00	--	12.59	28.4	40.99	25.46	--	59	67	294		49.4	0.2
2.	18:00	--	12.34	15.94	28.28	25.31	--	59	68	292		48.4	0.3
3.	19:00	--	12.54	16.8	29.34	24.42	--	61	69	302		48	0.3
4.	20:00	--	12.5	20.15	32.65	25.02	--	74	82	332		46.7	0.2
5.	21:00	--	12.7	22.01	34.7	13	--	75	83	335		46	0.2
6.	22:00	--	14.4	24.06	38.46	13.14	--	76	84	342		45.4	0.2
7.	23:00	--	15.2	15.51	30.71	13	--	29	32	202		47	0.2
8.	00:00	--	14.3	13.92	28.22	12.98	--	23	28	182		46	0.2
9.	1:00	--	12.3	13.54	25.84	13.43	--	83	92	358		47.1	0.3
10.	2:00	--	16.7	34.54	51.24	12.11	--	59	66	298		46	0.2
11.	3:00	--	15.3	33.9	49.2	12.77	--	64	71	312		46.9	0.3
12.	4:00	--	13.8	33.37	47.17	11.96	--	63	70	303	0.25	47	0.2
13.	5:00	--	16.2	36.5	52.7	8.71	--	62	63	302		47.1	0.2
14.	6:00	--	12.7	22.52	35.22	7.61	--	63	70	308		46.1	0.2
15.	7:00	--	14.6	29.21	43.81	4.54	--	67	75	315		46.7	0.3
16.	8:00	--	16.2	38.9	55.1	5.2	--	66	73	312		47.3	0.2
17.	9:00	0.5	12.55	12.01	24.56	5.54	--	68	76	321		47.1	0.3
18.	10:00	0.5	12.6	12.3	24.9	5.62	--	59	66	292		47.2	0.2
19.	11:00	1.5	12.63	12.32	24.95	3.48	--	60	67	303		48	0.2
20.	12:00	1.5	12.54	11.17	23.71	2.81	--	58	65	300		47.5	0.2
21.	13:00	0.5	12.54	11.11	23.65	2.99	22.7	59	66	302		48.1	0.1
22.	14:00	0.5	12.5	11.11	23.65	3.4	--	14	15	134		48	0.4
23.	15:00	1	12.44	11.17	23.61	3.48	--	24	27	165		49	0.3
24.	16:00	0	14.58	11.33	25.91	3.45	--	24	29	166		48.5	0.3

HSE SERVICES

ENVIRONMENTAL TESTING LABORATORY

TEST REPORT

Job No.	HSE/LHE/01-1/2021	**Date of Issuance**	06-01-2021
Sample Information			
Commodity	Ambient Air Quality Monitoring	**Reference No.**	HSE/LHE/IND/01-D/21
Location	AN5 MEX	**Sampling Duration**	24 Hours
Co-ordinates	25.0039, 67.3575	**Date of Analysis**	28-12-2020 till 29-12-2020
Client/Establishment			
Name	**National Engineering Services Pakistan Pvt. Ltd**		
Address & Location	**NESPAK House 1-C, Block-N, Model Town Extension, Lahore**		

TEST RESULTS

Parameter	Averaging Time	SEQS	Unit	*Avg. Conc.	Methodology
Carbon Monoxide (CO)	8 h	**5**	mg/m^3	1.19	*NDIR
Sulfur Dioxide (SO_2)	24 h	**120**	$\mu g/m^3$	7.1	UV Fluorescence
Nitrogen Dioxide (NO_2)	24 h	**80**	$\mu g/m^3$	21.33	Chemiluminescence
Nitric Oxide (NO)	24 h	**40**	$\mu g/m^3$	14.14	Chemiluminescence
Oxides of Nitrogen (NOx)	24 h	**120**	$\mu g/m^3$	35.47	Chemiluminescence
Particulate Matter (PM_{10})	24 h	**150**	$\mu g/m^3$	45.6	Beta-Ray Absorption
Particulate Matter ($PM_{2.5}$)	24 h	**75**	$\mu g/m^3$	39.6	Beta-Ray Absorption
Suspended Particulates (SPM)	24 h	**500**	$\mu g/m^3$	269.7	Gravimetric Sampling
Ozone (O_3)	1 h	**130**	$\mu g/m^3$	21.6	Non-Dispersive UV Absorption Method
Lead	24 h	**1.5**	$\mu g/Nm^3$	0.32	AAS Method
Noise	Day-time 16:00 h	**65**	dB (A)	49.42	ASTM E-1124
	Night-time 8:00 h	**55**		47.75	ASTM E-1124
Vibration*	24 h	**--**	mm/s	0.34	ISO 2954

For Detailed Monitoring Results Please see **Log Table 10.0*

HSE SERVICES

24 Hour Monitoring Data for Ambient Air

Log Table 10.0

Sr. No.	Time	CO	NO	NO_2	NO_x	SO_2	O_3	$PM_{2.5}$	PM_{10}	SPM	Lead	Noise	Vibration
		mg/m^3	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	dB(A)	mm/sec
1.	18:00	--	12.02	34.32	46.34	7.6	--	48	53	286		49.6	0.6
2.	19:00	--	14.55	43.51	58.06	7.1	--	40	44	272		50	0.4
3.	20:00	--	13.95	26.32	40.27	5.1	--	41	45	275		59.9	0.5
4.	21:00	--	16.86	13.54	30.4	6.7	--	43	47	277		50.1	0.3
5.	22:00	--	12.97	12.19	25.16	7.14	--	45	52	284		52	0.5
6.	23:00	--	13.44	12.04	25.48	7.6	--	44	53	284		53	0.2
7.	00:00	--	15.42	16.46	31.88	8.3	--	47	54	288		52	0.2
8.	1:00	--	13.21	44.33	57.54	10.31	--	45	53	285		51	0.4
9.	2:00	--	16.12	23.76	39.88	11.68	--	44	53	285		50	0.2
10.	3:00	--	15.37	33.69	49.06	7.71	--	70	80	342		45	0.1
11.	4:00	--	12.98	12.32	25.3	6.4	--	81	90	364		44	0.2
12.	5:00	--	12.85	42.31	55.16	6.15	--	64	76	321	0.32	43	0.3
13.	6:00	--	16.23	19.88	36.11	6.5	--	35	39	265		44	0.2
14.	7:00	--	16.16	17.32	33.48	6.17	--	30	33	254		43.2	0.2
15.	8:00	--	15.2	32.2	47.4	5.65	--	28	31	232		46.2	0.3
16.	9:00	0.5	16.11	22.1	38.21	5.23	--	28	31	234		48.4	0.3
17.	10:00	0	16.31	22.31	38.62	5.7	--	23	24	221		49.1	0.2
18.	11:00	1	14.04	15.7	29.74	6.7	--	36	40	264		48.9	0.4
19.	12:00	1.5	12.58	13.2	25.78	7.68	--	29	37	253		49	0.3
20.	13:00	1.5	12.51	7.314	19.824	7.31	21.6	24	32	230		48	0.4
21.	14:00	1.5	12.46	6.836	19.3	6.84	--	28	36	237		50	0.4
22.	15:00	2	12.7	6.9	19.6	6.9	--	25	28	236		48.3	0.5
23.	16:00	1.5	12.43	15.3	27.73	6.74	--	28	36	244		49.1	0.6
24.	17:00	--	12.72	18.2	30.92	6.72	--	25	28	239		48.9	0.4

NOTE:
***SEQs:** Sindh Environmental Quality Standards
***NDIR**: Non-Dispersive Infrared Spectrophotometry
* There is no limit defined in SEQS. However, the permissible average concentration of continuous vibration in operational phase of EIA is <6.25 mm/sec.
Comments/Remarks:

- The client is responsible for lawful usage of reported data in future.
- This report is not valid for any negotiation or judicial use.
- The measurement results based on the time of monitoring.
- Results relate only to the items tested without prejudice.
- This test report shall not be reproduced except in full, without written approval of the Laboratory.

HSE SERVICES

Water Analysis Test Report

Report No.	HSE/ENV/20/DEC/GW/1340/SEQS2016/GW-01	**Reporting Date**	Tuesday, January 5, 2021
Client Name	M/s NESPAK Pvt. Ltd.		
Client Address	1-C, Block-N, Model Town Extension, Lahore.		
Sample Nature	Ground Water	**Quantity Of Sample**	1 Liter
Sample Collected By	HSE Services	**Sampling Methodology**	Grab
Sampling Location	GW-1 MEX	**Sampling Coordinates**	24º 52'8.33"N, 67º13'11.08"E
Date of Sample Collection	Monday, December 28, 2020	**Analysis Type**	Chemical / Microbiology
Date of Sample Received	Monday, December 28, 2020		

S. No	Measuring Parameter	Units	Testing Method	SEQS*	Test Results	Remarks
1	pH @ 25 ˚C	pH	ASTM D-1293	6.5-8.5	6.81	Within SEQS
2	Total Dissolved Solids	(mg/L)	APHA 2540-C	<1000	1415	Exceeds SEQS
3	Phenolic compound	(mg/L)	Lovibond-315	0.002	BDL	Within SEQS
4	Chloride	(mg/L)	ASTM D-512	<250	477.49	Exceeds SEQS
5	Total Hardness as $CaCO_3$	(mg/L)	ASTM D-1126	<500	741.2	Exceeds SEQS
6	Aluminum	(mg/L)	Lovibond-40	0.2	<0	Within SEQS
7	Residual Chlorine	(mg/L)	Lovibond-100	0.2-0.5	<0.1	Within SEQS
8	Antimony	(mg/L)	ASTM D-3697	<0.005	ND	Within SEQS
9	Arsenic	(mg/L)	Palintest Method	0.05	ND	Within SEQS
10	Taste	…..	Sensory Method	Non Objectionable	Non Objectionable	--
11	Odor	…..	Sensory Method	Non Objectionable	Non Objectionable	--
12	Barium	(mg/L)	ASTM D-4382	0.7	0.09	Within SEQS
13	Boron	(mg/L)	Lovibond-85	0.3	0.1	Within SEQS
14	Copper	(mg/L)	Lovibond-149	2.0	<0.05	Within SEQS
15	Lead	(mg/L)	Lovibond-232	<0.05	ND	Within SEQS
16	Mercury	(mg/L)	Kit Method	<0.001	ND	Within SEQS
17	Nickel	(mg/L)	Lovibond-255	<0.02	ND	Within SEQS
18	Manganese	(mg/L)	Lovibond-242	0.5	<0.01	Within SEQS
19	Zinc	(mg/L)	Lovibond-400	<5	0.06	Within SEQS
20	Selenium	(mg/L)	APHA 4500 Se	0.01	BDL	Within SEQS
21	Cyanide	(mg/L)	Lovibond-156	0.05	ND	Within SEQS

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22	Chromium	(mg/L)	Lovibond-124	<0.05	0.005	Within SEQS
23	Fluoride	(mg/L)	Lovibond-170	1.5	1.01	Within SEQS
24	Cadmium	(mg/L)	Lovibond-87	0.01	ND	Within SEQS
25	Nitrate	(mg/L)	Lovibond-265	0.5	BDL	Within SEQS
26	Nitrite	(mg/L)	Lovibond-270	3	BDL	Within SEQS
27	Color	TCU	APHA Pt-Co Scale	<15TCU	4	Within SEQS
28	Turbidity	NTU	Lovibond-385	<5	<5	Within SEQS
29	Total Coliform	count/100ml	APHA9222-B	0/100ml	ND	Within SEQS
30	Escherichia Coli	count/100ml	APHA9222-D	0/100ml	ND	Within SEQS
31	Pesticides	mg/L	HPLC	0.15	ND	Within SEQS

HSE SERVICES

Water Analysis Test Report

Report No.	HSE/ENV/20/DEC/GW/1340/ SEQS2016/GW-02	**Reporting Date**	Tuesday, January 5, 2021
Client Name	M/s NESPAK Pvt. Ltd.		
Client Address	1-C, Block-N, Model Town Extension, Lahore.		
Sample Nature	Ground Water	**Quantity Of Sample**	1 Liter
Sample Collected By	HSE Services	**Sampling Methodology**	Grab
Sampling Location	GW-2 MEX	**Sampling Coordinates**	24°58'3.65"N, 67°19'24.15"E
Date of Sample Collection	Monday, December 28, 2020	**Analysis Type**	Chemical / Microbiology
Date of Sample Received	Monday, December 28, 2020		

S. No	Measuring Parameter	Units	Testing Method	SEQS*	Test Results	Remarks
1	pH @ 25 ˚C	pH	ASTM D-1293	6.5-8.5	6.79	Within SEQS
2	Total Dissolved Solids	(mg/L)	APHA 2540-C	<1000	310	Within SEQS
3	Phenolic compound	(mg/L)	Lovibond-315	0.002	BDL	Within SEQS
4	Chloride	(mg/L)	ASTM D-512	<250	48.39	Within SEQS
5	Total Hardness as $CaCO_3$	(mg/L)	ASTM D-1126	<500	183.12	Within SEQS
6	Aluminum	(mg/L)	Lovibond-40	0.2	<0.01	Within SEQS
7	Residual Chlorine	(mg/L)	Lovibond-100	0.2-0.5	<0.1	Within SEQS
8	Antimony	(mg/L)	ASTM D-3697	<0.005	ND	Within SEQS
9	Arsenic	(mg/L)	Palintest Method	0.05	ND	Within SEQS
10	Taste	…..	Sensory Method	Non Objectionable	Non Objectionable	--
11	Odor	…..	Sensory Method	Non Objectionable	Non Objectionable	--
12	Barium	(mg/L)	ASTM D-4382	0.7	ND	Within SEQS
13	Boron	(mg/L)	Lovibond-85	0.3	<0.1	Within SEQS
14	Copper	(mg/L)	Lovibond-149	2.0	<0.05	Within SEQS
15	Lead	(mg/L)	Lovibond-232	<0.05	ND	Within SEQS
16	Mercury	(mg/L)	Kit Method	<0.001	ND	Within SEQS
17	Nickel	(mg/L)	Lovibond-255	<0.02	ND	Within SEQS
18	Manganese	(mg/L)	Lovibond-242	0.5	ND	Within SEQS
19	Zinc	(mg/L)	Lovibond-400	<5	0.06	Within SEQS
20	Selenium	(mg/L)	APHA 4500 Se	0.01	BDL	Within SEQS
21	Cyanide	(mg/L)	Lovibond-156	0.05	ND	Within SEQS

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22	Chromium	(mg/L)	Lovibond-124	<0.05	ND	Within SEQS
23	Fluoride	(mg/L)	Lovibond-170	1.5	0.8	Within SEQS
24	Cadmium	(mg/L)	Lovibond-87	0.01	ND	Within SEQS
25	Nitrate	(mg/L)	Lovibond-265	0.5	BDL	Within SEQS
26	Nitrite	(mg/L)	Lovibond-270	3	BDL	Within SEQS
27	Color	TCU	APHA Pt-Co Scale	<15TCU	2	Within SEQS
28	Turbidity	NTU	Lovibond-385	<5	<5	Within SEQS
29	Total Coliform	count/100ml	APHA9222-B	0/100ml	32	Exceeds SEQS
30	Escherichia Coli	count/100ml	APHA9222-D	0/100ml	10	Exceeds SEQS
31	Pesticides	mg/L	HPLC	0.15	ND	Within SEQS

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Water Analysis Test Report

Report No.	HSE/ENV/20/DEC/SW/1340 /SEQS2016/SW-01	**Reporting Date**	Tuesday, January 5, 2021
Client Name	M/s NESPAK Pvt. Ltd.		
Client Address	1-C, Block-N, Model Town Extension, Lahore.		
Sample Nature	Surface Water	**Quantity Of Sample**	1 Liter
Sample Collected By	HSE Services	**Sampling Methodology**	Grab
Sampling Location	SW-1 MEX	**Sampling Coordinates**	24º49'57.66"N, 67º5'21.44"E
Date of Sample Collection	Monday, December 28, 2020	**Analysis Type**	Chemical
Date of Sample Received	Monday, December 28, 2020		

S. No	Measuring Parameter	Units	Testing Method	SEQS*	Test Results	Remarks
1	Temperature	◦C	By Calibrated Thermometer	40 + ≤ 03	21	Within SEQS
2	pH @ 25 ˚C	pH	ASTM D-1293	6 to 9	7.72	Within SEQS
3	Biological Oxygen Demand (BOD_5)	(mg/L)	APHA 5210	80	28	Within SEQS
4	Chemical Oxygen Demand	(mg/L)	ASTM D-1252	150	102	Within SEQS
5	Total Dissolved Solids	(mg/L)	APHA 2540-C	3500	3055	Within SEQS
6	Total Suspended Solids	(mg/L)	APHA 2540-D	200	38	Within SEQS
7	Oil & Grease	(mg/L)	ASTM D-4281	10	6	Within SEQS
8	Chloride	(mg/L)	ASTM D-512	1000	1316.21	Exceeds SEQS
9	Phenolic compound	(mg/L)	Lovibond 4-Amino Antipyrine	0.1	<0.1	Within SEQS
10	Fluoride	(mg/L)	Lovibond SPADNS Reagent Method	10	1.34	Within SEQS
11	Anionic Detergent	(mg/L)	ASTM D-6173	20	0.02	Within SEQS
12	Selenium	(mg/L)	APHA 4500 Se	0.5	BDL	Within SEQS
13	Sulfide	(mg/L)	LovIbond DPD/Catalyst	1.0	0.04	Within SEQS
14	Ammonia	(mg/L)	Lovibond Indophenol Blue Method	40	1.38	Within SEQS

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15	Cadmium	(mg/L)	Lovibond Cadion Method	0.1	ND	Within SEQS
16	Chromium	(mg/L)	Lovibond 1,5-diphenyl-Carbohydrazide Method	1.0	0.008	Within SEQS
17	Copper	(mg/L)	Lovibond Biquinoline Method	1.0	<0.05	Within SEQS
18	Lead	(mg/L)	Lovibond 4-(2-Pyridylazo)-resorcin	0.5	ND	Within SEQS
19	Mercury	(mg/L)	Kit Method	0.01	ND	Within SEQS
20	Nickel	(mg/L)	Lovibond Dimethylglyoxime Method	1.0	ND	Within SEQS
21	Silver	(mg/L)	ASTM-D3866	1.0	ND	Within SEQS
22	Zinc	(mg/L)	Lovibond Zincon Method	5.0	0.09	Within SEQS
23	Total Iron	(mg/L)	Lovibond PPST Method	8.0	0.61	Within SEQS
24	Manganese	mg/L)	Lovibond PAN Method	1.5	<0.01	Within SEQS
25	Boron	(mg/L)	Lovibond Azomethine Method	6.0	0.2	Within SEQS
26	Sulfate	(mg/L)	Lovibond Bariumsulfate Turbidity	600	298	Within SEQS
27	Arsenic	(mg/L)	Palintest Kit	1.0	ND	Within SEQS
28	Chlorine	(mg/L)	Lovibond DPD Method	1.0	0.93	Within SEQS
29	Total Toxic Metals	(mg/L)	Kit Method	2.0	<2	Within SEQS
30	Barium	(mg/L)	ASTM D-4382	1.5	0.11	Within SEQS
31	Cyanide	(mg/L)	Lovibond Pyridine Barbituric Acid	1.0	ND	Within SEQS

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Water Analysis Test Report

Report No.	HSE/ENV/20/DEC/SW/1340 /SEQS2016/SW-02	**Reporting Date**	Tuesday, January 5, 2021
Client Name	M/s NESPAK Pvt. Ltd.		
Client Address	1-C, Block-N, Model Town Extension, Lahore.		
Sample Nature	Surface Water	**Quantity Of Sample**	1 Liter
Sample Collected By	HSE Services	**Sampling Methodology**	Grab
Sampling Location	SW-2 MEX	**Sampling Coordinates**	24°53'0.62"N, 67°14'9.3"E
Date of Sample Collection	Monday, December 28, 2020	**Analysis Type**	Chemical
Date of Sample Received	Monday, December 28, 2020		

S. No	Measuring Parameter	Units	Testing Method	SEQS*	Test Results	Remarks
1	Temperature	◦C	By Calibrated Thermometer	40 + ≤ 03	22	Within SEQS
2	pH @ 25 ˚C	pH	ASTM D-1293	6 to 9	7.61	Within SEQS
3	Biological Oxygen Demand (BOD_5)	(mg/L)	APHA 5210	80	16	Within SEQS
4	Chemical Oxygen Demand	(mg/L)	ASTM D-1252	150	47	Within SEQS
5	Total Dissolved Solids	(mg/L)	APHA 2540-C	3500	250	Within SEQS
6	Total Suspended Solids	(mg/L)	APHA 2540-D	200	32	Within SEQS
7	Oil & Grease	(mg/L)	ASTM D-4281	10	<5	Within SEQS
8	Chloride	(mg/L)	ASTM D-512	1000	64.52	Within SEQS
9	Phenolic compound	(mg/L)	Lovibond 4-Amino Antipyrine	0.1	<0.1	Within SEQS
10	Fluoride	(mg/L)	Lovibond SPADNS Reagent Method	10	0.78	Within SEQS
11	Anionic Detergent	(mg/L)	ASTM D-6173	20	0.01	Within SEQS
12	Selenium	(mg/L)	APHA 4500 Se	0.5	BDL	Within SEQS
13	Sulfide	(mg/L)	LovIbond DPD/Catalyst	1.0	<0.04	Within SEQS
14	Ammonia	(mg/L)	Lovibond Indophenol Blue Method	40	2.04	Within SEQS

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15	Cadmium	(mg/L)	Lovibond Cadion Method	0.1	ND	Within SEQS
16	Chromium	(mg/L)	Lovibond 1,5-diphenyl-Carbohydrazide Method	1.0	<0.005	Within SEQS
17	Copper	(mg/L)	Lovibond Biquinoline Method	1.0	<0.05	Within SEQS
18	Lead	(mg/L)	Lovibond 4-(2-Pyridylazo)-resorcin	0.5	ND	Within SEQS
19	Mercury	(mg/L)	Kit Method	0.01	ND	Within SEQS
20	Nickel	(mg/L)	Lovibond Dimethylglyoxime Method	1.0	ND	Within SEQS
21	Silver	(mg/L)	ASTM-D3866	1.0	ND	Within SEQS
22	Zinc	(mg/L)	Lovibond Zincon Method	5.0	0.04	Within SEQS
23	Total Iron	(mg/L)	Lovibond PPST Method	8.0	0.36	Within SEQS
24	Manganese	mg/L)	Lovibond PAN Method	1.5	0.01	Within SEQS
25	Boron	(mg/L)	Lovibond Azomethine Method	6.0	<0.1	Within SEQS
26	Sulfate	(mg/L)	Lovibond Bariumsulfate Turbidity	600	22.2	Within SEQS
27	Arsenic	(mg/L)	Palintest Kit	1.0	ND	Within SEQS
28	Chlorine	(mg/L)	Lovibond DPD Method	1.0	0.91	Within SEQS
29	Total Toxic Metals	(mg/L)	Kit Method	2.0	<2	Within SEQS
30	Barium	(mg/L)	ASTM D-4382	1.5	ND	Within SEQS
31	Cyanide	(mg/L)	Lovibond Pyridine Barbituric Acid	1.0	ND	Within SEQS

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Water Analysis Test Report

Report No.	HSE/ENV/20/DEC/SW/1340 /SEQS2016/SW-03	**Reporting Date**	Tuesday, January 5, 2021
Client Name	M/s NESPAK Pvt. Ltd.		
Client Address	1-C, Block-N, Model Town Extension, Lahore.		
Sample Nature	Surface Water	**Quantity Of Sample**	1 Liter
Sample Collected By	HSE Services	**Sampling Methodology**	Grab
Sampling Location	SW-3 MEX	**Sampling Coordinates**	24º59'19.99"N, 67º21'39.42"E
Date of Sample Collection	Friday, January 1, 2021	**Analysis Type**	Chemical
Date of Sample Received	Friday, January 1, 2021		

S. No	Measuring Parameter	Units	Testing Method	SEQS*	Test Results	Remarks
1	Temperature	◦C	By Calibrated Thermometer	40 + ≤ 03	16	Within SEQS
2	pH @ 25 ˚C	pH	ASTM D-1293	6 to 9	7.5	Within SEQS
3	Biological Oxygen Demand (BOD_5)	(mg/L)	APHA 5210	80	30	Within SEQS
4	Chemical Oxygen Demand	(mg/L)	ASTM D-1252	150	96	Within SEQS
5	Total Dissolved Solids	(mg/L)	APHA 2540-C	3500	1705	Within SEQS
6	Total Suspended Solids	(mg/L)	APHA 2540-D	200	52	Within SEQS
7	Oil & Grease	(mg/L)	ASTM D-4281	10	<5	Within SEQS
8	Chloride	(mg/L)	ASTM D-512	1000	641.97	Within SEQS
9	Phenolic compound	(mg/L)	Lovibond 4-Amino Antipyrine	0.1	<0.1	Within SEQS
10	Fluoride	(mg/L)	Lovibond SPADNS Reagent Method	10	1.38	Within SEQS
11	Anionic Detergent	(mg/L)	ASTM D-6173	20	0.12	Within SEQS
12	Selenium	(mg/L)	APHA 4500 Se	0.5	ND	Within SEQS
13	Sulfide	(mg/L)	LovIbond DPD/Catalyst	1.0	0.06	Within SEQS
14	Ammonia	(mg/L)	Lovibond Indophenol Blue Method	40	2.01	Within SEQS

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15	Cadmium	(mg/L)	Lovibond Cadion Method	0.1	ND	Within SEQS
16	Chromium	(mg/L)	Lovibond 1,5-diphenyl-Carbohydrazide Method	1.0	0.009	Within SEQS
17	Copper	(mg/L)	Lovibond Biquinoline Method	1.0	<0.05	Within SEQS
18	Lead	(mg/L)	Lovibond 4-(2-Pyridylazo)-resorcin	0.5	ND	Within SEQS
19	Mercury	(mg/L)	Kit Method	0.01	ND	Within SEQS
20	Nickel	(mg/L)	Lovibond Dimethylglyoxime Method	1.0	ND	Within SEQS
21	Silver	(mg/L)	ASTM-D3866	1.0	ND	Within SEQS
22	Zinc	(mg/L)	Lovibond Zincon Method	5.0	0.06	Within SEQS
23	Total Iron	(mg/L)	Lovibond PPST Method	8.0	0.12	Within SEQS
24	Manganese	mg/L)	Lovibond PAN Method	1.5	<0.01	Within SEQS
25	Boron	(mg/L)	Lovibond Azomethine Method	6.0	0.2	Within SEQS
26	Sulfate	(mg/L)	Lovibond Bariumsulfate Turbidity	600	0.52	Within SEQS
27	Arsenic	(mg/L)	Palintest Kit	1.0	ND	Within SEQS
28	Chlorine	(mg/L)	Lovibond DPD Method	1.0	0.12	Within SEQS
29	Total Toxic Metals	(mg/L)	Kit Method	2.0	<2	Within SEQS
30	Barium	(mg/L)	ASTM D-4382	1.5	0.07	Within SEQS
31	Cyanide	(mg/L)	Lovibond Pyridine Barbituric Acid	1.0	ND	Within SEQS

NOTE:

*Water is colored which cannot be tasted, hence, stated objectionable.
ND=Not Detectable
BDL=Below Detectable Limit
SEQS= Sindh Environmental Quality Standards.
The instruments used were duly calibrated.
The measurements were carried out on client's request.
The client is responsible for lawful usage of reported data in future.
This report is not valid for Court evidence/ Judicial Knowledge.
Company is not responsible for any query if sample is given by Client
Report is just valid for given sample.

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4. Findings & Recommendations:

Reference to the aforementioned observations, it is found that overall monitoring was conducted successfully at all 5 points without any significant interruption. Almost all parameters of Ambient Air & Noise are in compliance with SEQS 2016 except NO2 & NOx at 1 point respectively.

- ✓ Frequent commutation of public vehicles at roadside produce high NO2 which can be a risk for workers or people who are at constant exposure.
  - ✓ It is recommended for workers/people to use respirators during constant exposure
  - ✓ Take frequent breaks to avoid constant exposure

Almost all parameters of wastewater and drinking water are in compliance with SEQS 2016 except chlorides, hardness, total dissolved solids, E.coli and Total Coliform of one drinking water sample (GW-2 MEX) and chlorides of one surface water sample respectively.

5. Conclusion:

Environmental monitoring of five (5) locations of Malir Expressway Project reveals that most of the parameters of Ambient Air, Noise & Water Sampling are in compliance with SEQS 2016. However, few deviations were also highlighted and they should be dealt with as per recommendations and applicable controls.

Verified by:



Mariya Gohar
Analyst
HSE Services

Date of Issue: January 16, 2021

HSE SERVICES

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Annex IX – IBAT Freshwater Reports

Integrated Biodiversity Assessment Tool

FRESHWATER REPORT
MALIR EXPRESSWAY 1

Country: Pakistan

Location: [25, 67.3]

Date of analysis: 19 March 2021 (GMT)

Upstream: 5 km | 10 km | 30 km

Downstream: -10 km | -30 km | -50 km

Generated by: Shazia Shahid

Organisation: ADB

About this report

This report presents the results of [1400-14861] freshwater analysis and is one part of a package generated by IBAT that includes a full list of species in CSV format and a README file.

IBAT allows users to query data on freshwater species from The IUCN Red List of Threatened Species™. The IUCN Red List spatial data for freshwater species have recently been transferred to a new global sub-basin system (HydroBASINS) which has additional attributes that allow for upstream and downstream sub-basins to be identified. This has allowed for the development of additional functionality by which IBAT users can also identify which species are in specific upstream or downstream sub-basins from a sites of interest. This reflects the unique nature of freshwater systems, which have high degrees of connectivity meaning pressures can be transported large distances. Using the HydroBASINS attributes and updated species distributions mapped to sub-basins allows for enhanced understanding and leverages additional IUCN Red List data.

Specifically, this report will help answer:

- What species are native to a specific project site and the sub-basins hydrologically connected (upstream and downstream) to the project site?
- What are the IUCN Red List Categories of these species?
- What are the movement patterns (migratory status) of these species?

This new functionality will allow IBAT users to query species data not only in the sub-basins that directly overlay a project site but also in the sub-basins linked upstream and downstream, reflecting the high levels of connectivity and spread of pressures within freshwater systems.

Data used to generate this report: IUCN Red List - Jan 2021.

Please note the data caveats.

IUCN, together with the IUCN Species Survival Commission (SSC), are working to complete a comprehensive assessment of all described species of freshwater fishes, molluscs, odonates, decapods, turtles and crocodilians, as well as selected freshwater plants, for the IUCN Red List of Threatened Species. This assessment is not yet complete and as a result comprehensive freshwater biodiversity data are currently not available for some regions of the world. Comprehensive assessments have been completed for the freshwater crabs, crayfishes, shrimps and crocodilians. However, only those species with HydroBASINS spatial data will be considered in the report, meaning for example some assessed crocodilians without HydroBASINS will not be considered.

Additionally, it is not required to code the movement patterns (migratory status) of a species in a Red List assessment and so this information will be missing for some species. However, all freshwater fishes that are migratory should be coded as such.

Summary

Downstream Threatened species (CR+EN+VU) information

Taxonomic group	Site sub-basin	Species in downstream -10 km	Species in downstream -30 km	Species in downstream -50 km	Species in downstream beyond -50 km	Total Species
ODONATES	0	0	0	0	0	0
DECAPODS	0	0	0	0	0	0
FISHES	2	0	0	0	0	2
MOLLUSCS	0	0	0	0	0	0
PLANTS	0	0	0	0	0	0
All	2	0	0	0	0	2

Upstream Threatened species (CR+EN+VU) information

Taxonomic group	Site sub-basin	Species in upstream 5 km	Species in upstream 10 km	Species in upstream 30 km	Species in upstream beyond 30 km	Total Species
ODONATES	0	0	0	0	0	0
DECAPODS	0	0	0	0	0	0
FISHES	2	0	0	0	0	2
MOLLUSCS	0	0	0	0	0	0
PLANTS	0	0	0	0	0	0
All	2	0	0	0	0	2

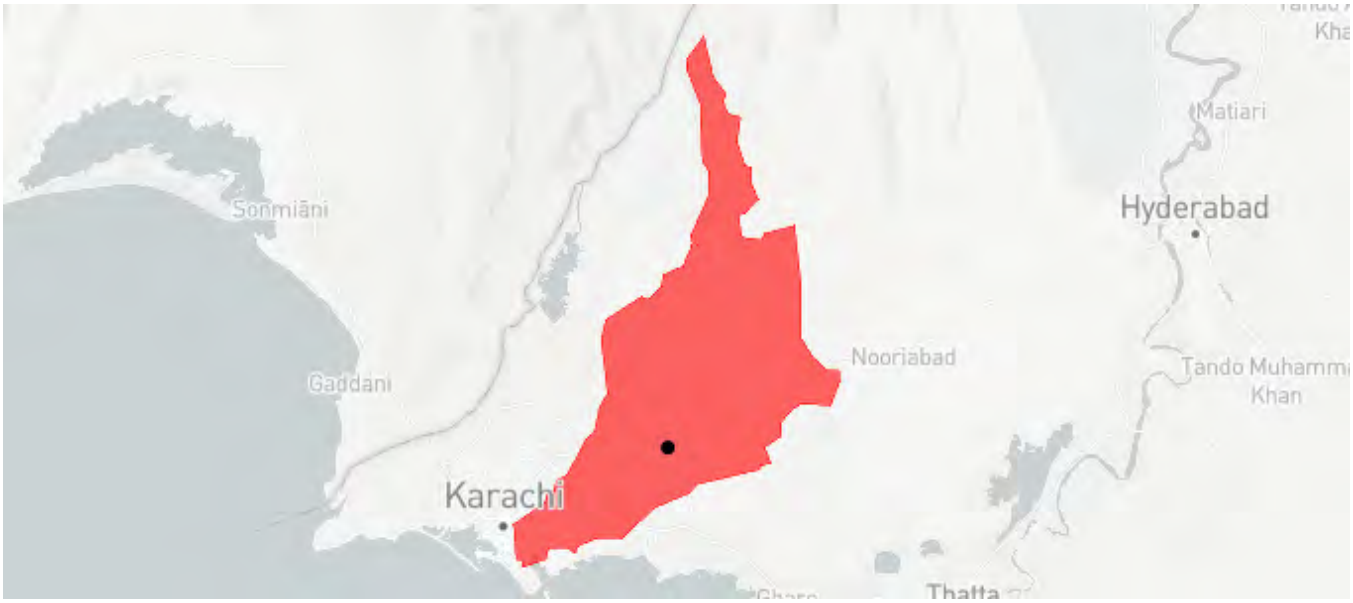
Downstream Migratory species information

Taxonomic group	Site sub-basin	Species in downstream -10 km	Species in downstream -30 km	Species in downstream -50 km	Species in downstream beyond -50 km	Total Species
ODONATES	3	0	0	0	0	3
DECAPODS	0	0	0	0	0	0
FISHES	8	0	0	0	0	8
MOLLUSCS	0	0	0	0	0	0
PLANTS	0	0	0	0	0	0
All	11	0	0	0	0	11

Upstream Migratory species information

Taxonomic group	Site sub-basin	Species in upstream 5 km	Species in upstream 10 km	Species in upstream 30 km	Species in upstream beyond 30 km	Total Species
ODONATES	3	0	0	0	0	3
DECAPODS	0	0	0	0	0	0
FISHES	8	0	0	0	0	8
MOLLUSCS	0	0	0	0	0	0
PLANTS	0	0	0	0	0	0
All	11	0	0	0	0	11

Site sub-basin



Site sub-basin

Upstream (km)	Downstream (km)
0.01 to 5	-0.01 to -10
5.01 to 10	-10.01 to -30
10.01 to 30	-30.01 to -50
beyond 30	beyond -50

Sub-basin information

Category (distance from site km)	No. of sub basins in category	Area of category km²
0	1	2270

Species Richness Information

Number of freshwater species present in selected sub-basins in total, grouped by taxonomy and by Red List Category.

Taxonomic group	All species	Critically Endangered	Endangered	Vulnerable	Near Threatened
ODONATES	14	0	0	0	0
DECAPODS	2	0	0	0	0
FISHES	24	0	0	2	0
MOLLUSCS	14	0	0	0	0
PLANTS	11	0	0	0	0
All	65	0	0	2	0

Threatened species (CR+EN+VU)

Details of threatened freshwater species present in selected sub-basins. For the full IUCN Red List please refer to the associated csv in the report folder.

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Wallago attu		FISHES	VU	Decreasing	Freshwater
Bagarius yarrelli		FISHES	VU	Decreasing	Freshwater

Migratory Species

Details of migratory freshwater species present in selected sub-basins. For the full IUCN Red List please refer to the associated csv in the report folder.

Species Name	Common Name	Taxonomic Group	IUCN Category	Movement Pattern
Anax ephippiger	Vagrant Emperor	ODONATES	LC or LR/lc	Full Migrant
Tramea basilaris	Keyhole Glider	ODONATES	LC or LR/lc	Full Migrant
Channa gachua	Dwarf Snakehead	FISHES	LC or LR/lc	Full Migrant
Arius arius	Threadfin Sea Catfish	FISHES	LC or LR/lc	Full Migrant
Wallago attu		FISHES	VU	Full Migrant
Bagarius yarrelli		FISHES	VU	Full Migrant
Sperata aor	Long-whiskered Catfish	FISHES	LC or LR/lc	Full Migrant
Labeo bata	Minor Carp	FISHES	LC or LR/lc	Full Migrant
Silonia silondia	Silong Catfish	FISHES	LC or LR/lc	Full Migrant
Ischnura aurora	Gossamer Damselfly	ODONATES	LC or LR/lc	Full Migrant
Mystus gulio		FISHES	LC or LR/lc	Altitudinal Migrant

Upstream 0.01 to 5

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Upstream 5.01 to 10

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Upstream 10.01 to 30

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Upstream beyond 30

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Downstream -0.01 to -10

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Downstream -10.01 to -30

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Downstream -30.01 to -50

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Downstream beyond -50

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Recommended citation

IBAT Freshwater Report. Generated under licence 1400-14861 from the Integrated Biodiversity Assessment Tool on 19 March 2021 (GMT). www.ibat-alliance.org

Integrated Biodiversity Assessment Tool

FRESHWATER REPORT

MALIR 2

Country: Pakistan

Location: [24.9, 67.4]

Date of analysis: 19 March 2021 (GMT)

Upstream: 50 km | 100 km | 150 km

Downstream: -1 km | -2 km | -3 km

Generated by: Shazia Shahid

Organisation: ADB

About this report

This report presents the results of [1400-14862] freshwater analysis and is one part of a package generated by IBAT that includes a full list of species in CSV format and a README file.

IBAT allows users to query data on freshwater species from The IUCN Red List of Threatened Species™. The IUCN Red List spatial data for freshwater species have recently been transferred to a new global sub-basin system (HydroBASINS) which has additional attributes that allow for upstream and downstream sub-basins to be identified. This has allowed for the development of additional functionality by which IBAT users can also identify which species are in specific upstream or downstream sub-basins from a sites of interest. This reflects the unique nature of freshwater systems, which have high degrees of connectivity meaning pressures can be transported large distances. Using the HydroBASINS attributes and updated species distributions mapped to sub-basins allows for enhanced understanding and leverages additional IUCN Red List data.

Specifically, this report will help answer:

- What species are native to a specific project site and the sub-basins hydrologically connected (upstream and downstream) to the project site?
- What are the IUCN Red List Categories of these species?
- What are the movement patterns (migratory status) of these species?

This new functionality will allow IBAT users to query species data not only in the sub-basins that directly overlay a project site but also in the sub-basins linked upstream and downstream, reflecting the high levels of connectivity and spread of pressures within freshwater systems.

Data used to generate this report: IUCN Red List - Jan 2021.

Please note the data caveats.

IUCN, together with the IUCN Species Survival Commission (SSC), are working to complete a comprehensive assessment of all described species of freshwater fishes, molluscs, odonates, decapods, turtles and crocodilians, as well as selected freshwater plants, for the IUCN Red List of Threatened Species. This assessment is not yet complete and as a result comprehensive freshwater biodiversity data are currently not available for some regions of the world. Comprehensive assessments have been completed for the freshwater crabs, crayfishes, shrimps and crocodilians. However, only those species with HydroBASINS spatial data will be considered in the report, meaning for example some assessed crocodilians without HydroBASINS will not be considered.

Additionally, it is not required to code the movement patterns (migratory status) of a species in a Red List assessment and so this information will be missing for some species. However, all freshwater fishes that are migratory should be coded as such.

Summary

Downstream Threatened species (CR+EN+VU) information

Taxonomic group	Site sub-basin	Species in downstream -1 km	Species in downstream -2 km	Species in downstream -3 km	Species in downstream beyond -3 km	Total Species
ODONATES	0	0	0	0	0	0
DECAPODS	0	0	0	0	0	0
FISHES	2	0	0	0	0	2
MOLLUSCS	0	0	0	0	0	0
PLANTS	0	0	0	0	0	0
All	2	0	0	0	0	2

Upstream Threatened species (CR+EN+VU) information

Taxonomic group	Site sub-basin	Species in upstream 50 km	Species in upstream 100 km	Species in upstream 150 km	Species in upstream beyond 150 km	Total Species
ODONATES	0	0	0	0	0	0
DECAPODS	0	0	0	0	0	0
FISHES	2	0	0	0	0	2
MOLLUSCS	0	0	0	0	0	0
PLANTS	0	0	0	0	0	0
All	2	0	0	0	0	2

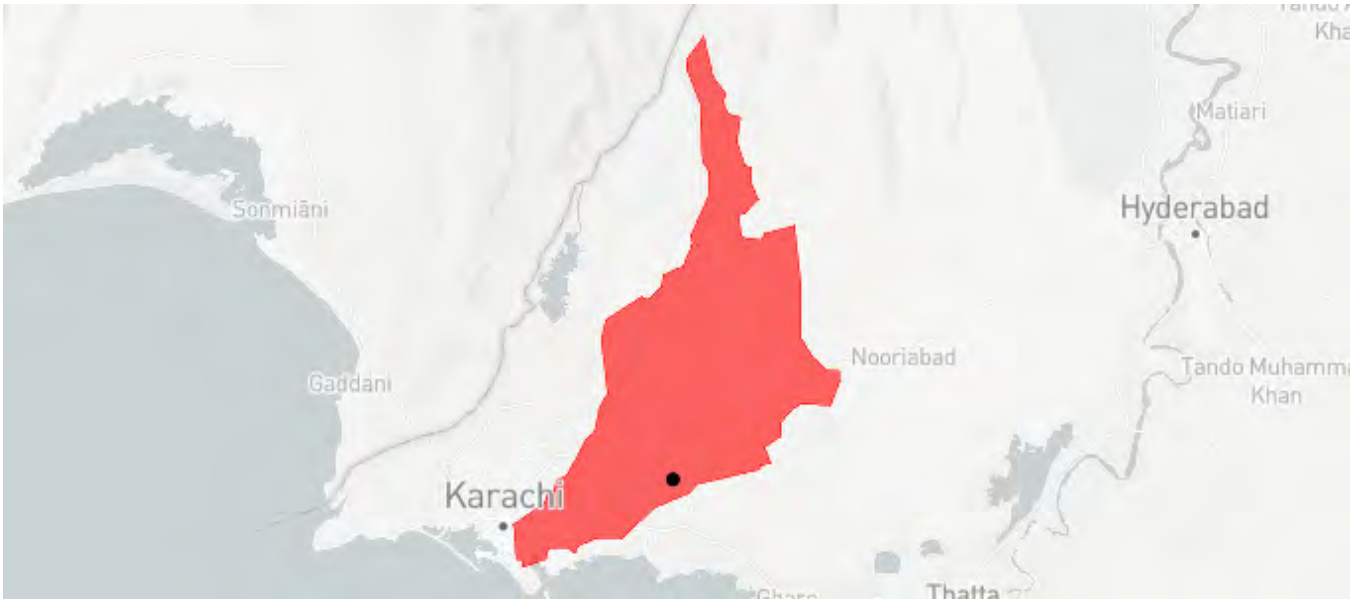
Downstream Migratory species information

Taxonomic group	Site sub-basin	Species in downstream -1 km	Species in downstream -2 km	Species in downstream -3 km	Species in downstream beyond -3 km	Total Species
ODONATES	3	0	0	0	0	3
DECAPODS	0	0	0	0	0	0
FISHES	8	0	0	0	0	8
MOLLUSCS	0	0	0	0	0	0
PLANTS	0	0	0	0	0	0
All	11	0	0	0	0	11

Upstream Migratory species information

Taxonomic group	Site sub-basin	Species in upstream 50 km	Species in upstream 100 km	Species in upstream 150 km	Species in upstream beyond 150 km	Total Species
ODONATES	3	0	0	0	0	3
DECAPODS	0	0	0	0	0	0
FISHES	8	0	0	0	0	8
MOLLUSCS	0	0	0	0	0	0
PLANTS	0	0	0	0	0	0
All	11	0	0	0	0	11

Site sub-basin



Site sub-basin

Upstream (km)	Downstream (km)
0.01 to 50	-0.01 to -1
50.01 to 100	-1.01 to -2
100.01 to 150	-2.01 to -3
beyond 150	beyond -3

Sub-basin information

Category (distance from site km)	No. of sub basins in category	Area of category km²
0	1	2270

Species Richness Information

Number of freshwater species present in selected sub-basins in total, grouped by taxonomy and by Red List Category.

Taxonomic group	All species	Critically Endangered	Endangered	Vulnerable	Near Threatened
ODONATES	14	0	0	0	0
DECAPODS	2	0	0	0	0
FISHES	24	0	0	2	0
MOLLUSCS	14	0	0	0	0
PLANTS	11	0	0	0	0
All	65	0	0	2	0

Threatened species (CR+EN+VU)

Details of threatened freshwater species present in selected sub-basins. For the full IUCN Red List please refer to the associated csv in the report folder.

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Wallago attu		FISHES	VU	Decreasing	Freshwater
Bagarius yarrelli		FISHES	VU	Decreasing	Freshwater

Migratory Species

Details of migratory freshwater species present in selected sub-basins. For the full IUCN Red List please refer to the associated csv in the report folder.

Species Name	Common Name	Taxonomic Group	IUCN Category	Movement Pattern
Anax ephippiger	Vagrant Emperor	ODONATES	LC or LR/lc	Full Migrant
Tramea basilaris	Keyhole Glider	ODONATES	LC or LR/lc	Full Migrant
Channa gachua	Dwarf Snakehead	FISHES	LC or LR/lc	Full Migrant
Arius arius	Threadfin Sea Catfish	FISHES	LC or LR/lc	Full Migrant
Wallago attu		FISHES	VU	Full Migrant
Bagarius yarrelli		FISHES	VU	Full Migrant
Sperata aor	Long-whiskered Catfish	FISHES	LC or LR/lc	Full Migrant
Labeo bata	Minor Carp	FISHES	LC or LR/lc	Full Migrant
Silonia silondia	Silong Catfish	FISHES	LC or LR/lc	Full Migrant
Ischnura aurora	Gossamer Damselfly	ODONATES	LC or LR/lc	Full Migrant
Mystus gulio		FISHES	LC or LR/lc	Altitudinal Migrant

Upstream 0.01 to 50

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Upstream 50.01 to 100

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Upstream 100.01 to 150

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Upstream beyond 150

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Downstream -0.01 to -1

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Downstream -1.01 to -2

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Downstream -2.01 to -3

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Downstream beyond -3

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Recommended citation

IBAT Freshwater Report. Generated under licence 1400-14862 from the Integrated Biodiversity Assessment Tool on 19 March 2021 (GMT). www.ibat-alliance.org

Integrated Biodiversity Assessment Tool

FRESHWATER REPORT

MALIR 3

Country: Pakistan

Location: [24.8, 67.1]

Date of analysis: 19 March 2021 (GMT)

Upstream: 40 km | 50 km | 70 km

Downstream: -50 km | -100 km | -150 km

Generated by: Shazia Shahid

Organisation: ADB

About this report

This report presents the results of [1400-14863] freshwater analysis and is one part of a package generated by IBAT that includes a full list of species in CSV format and a README file.

IBAT allows users to query data on freshwater species from The IUCN Red List of Threatened Species™. The IUCN Red List spatial data for freshwater species have recently been transferred to a new global sub-basin system (HydroBASINS) which has additional attributes that allow for upstream and downstream sub-basins to be identified. This has allowed for the development of additional functionality by which IBAT users can also identify which species are in specific upstream or downstream sub-basins from a sites of interest. This reflects the unique nature of freshwater systems, which have high degrees of connectivity meaning pressures can be transported large distances. Using the HydroBASINS attributes and updated species distributions mapped to sub-basins allows for enhanced understanding and leverages additional IUCN Red List data.

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- What species are native to a specific project site and the sub-basins hydrologically connected (upstream and downstream) to the project site?
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This new functionality will allow IBAT users to query species data not only in the sub-basins that directly overlay a project site but also in the sub-basins linked upstream and downstream, reflecting the high levels of connectivity and spread of pressures within freshwater systems.

Data used to generate this report: IUCN Red List - Jan 2021.

Please note the data caveats.

IUCN, together with the IUCN Species Survival Commission (SSC), are working to complete a comprehensive assessment of all described species of freshwater fishes, molluscs, odonates, decapods, turtles and crocodilians, as well as selected freshwater plants, for the IUCN Red List of Threatened Species. This assessment is not yet complete and as a result comprehensive freshwater biodiversity data are currently not available for some regions of the world. Comprehensive assessments have been completed for the freshwater crabs, crayfishes, shrimps and crocodilians. However, only those species with HydroBASINS spatial data will be considered in the report, meaning for example some assessed crocodilians without HydroBASINS will not be considered.

Additionally, it is not required to code the movement patterns (migratory status) of a species in a Red List assessment and so this information will be missing for some species. However, all freshwater fishes that are migratory should be coded as such.

Summary

Downstream Threatened species (CR+EN+VU) information

Taxonomic group	Site sub-basin	Species in downstream -50 km	Species in downstream -100 km	Species in downstream -150 km	Species in downstream beyond -150 km	Total Species
ODONATES	0	0	0	0	0	0
DECAPODS	0	0	0	0	0	0
FISHES	2	0	0	0	0	2
MOLLUSCS	0	0	0	0	0	0
PLANTS	0	0	0	0	0	0
All	2	0	0	0	0	2

Upstream Threatened species (CR+EN+VU) information

Taxonomic group	Site sub-basin	Species in upstream 40 km	Species in upstream 50 km	Species in upstream 70 km	Species in upstream beyond 70 km	Total Species
ODONATES	0	0	0	0	0	0
DECAPODS	0	0	0	0	0	0
FISHES	2	0	0	0	0	2
MOLLUSCS	0	0	0	0	0	0
PLANTS	0	0	0	0	0	0
All	2	0	0	0	0	2

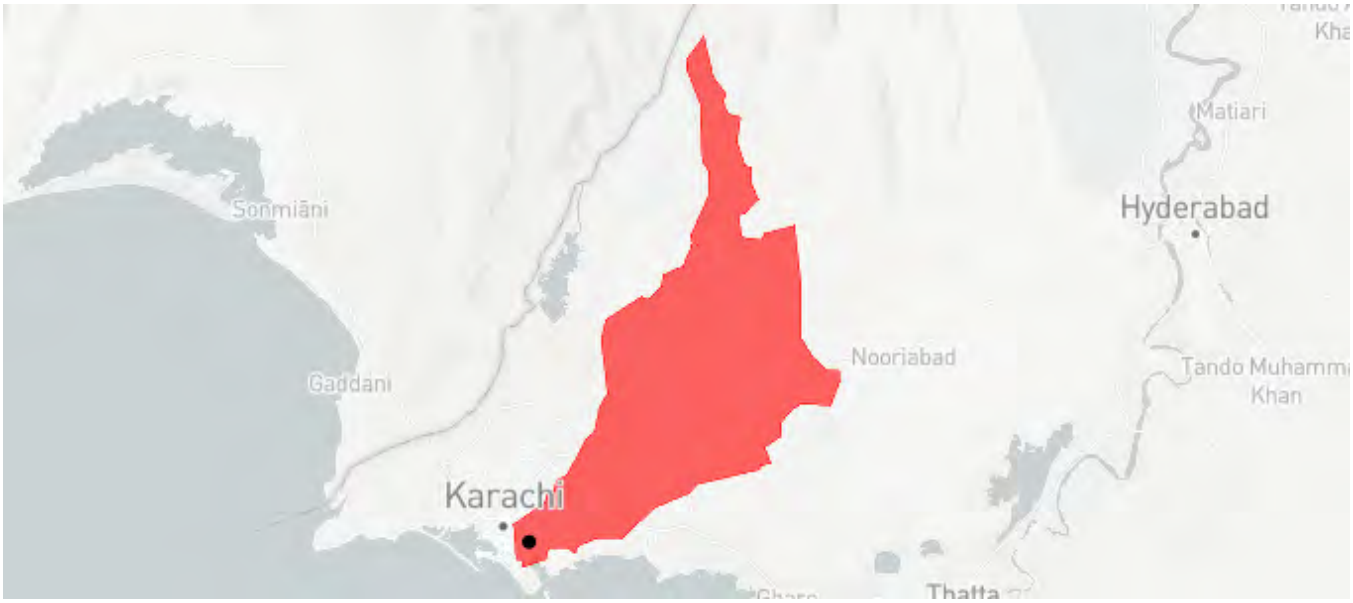
Downstream Migratory species information

Taxonomic group	Site sub-basin	Species in downstream -50 km	Species in downstream -100 km	Species in downstream -150 km	Species in downstream beyond -150 km	Total Species
ODONATES	3	0	0	0	0	3
DECAPODS	0	0	0	0	0	0
FISHES	8	0	0	0	0	8
MOLLUSCS	0	0	0	0	0	0
PLANTS	0	0	0	0	0	0
All	11	0	0	0	0	11

Upstream Migratory species information

Taxonomic group	Site sub-basin	Species in upstream 40 km	Species in upstream 50 km	Species in upstream 70 km	Species in upstream beyond 70 km	Total Species
ODONATES	3	0	0	0	0	3
DECAPODS	0	0	0	0	0	0
FISHES	8	0	0	0	0	8
MOLLUSCS	0	0	0	0	0	0
PLANTS	0	0	0	0	0	0
All	11	0	0	0	0	11

Site sub-basin



Site sub-basin

Upstream (km)	Downstream (km)
0.01 to 40	-0.01 to -50
40.01 to 50	-50.01 to -100
50.01 to 70	-100.01 to -150
beyond 70	beyond -150

Sub-basin information

Category (distance from site km)	No. of sub basins in category	Area of category km²
0	1	2270

Species Richness Information

Number of freshwater species present in selected sub-basins in total, grouped by taxonomy and by Red List Category.

Taxonomic group	All species	Critically Endangered	Endangered	Vulnerable	Near Threatened
ODONATES	14	0	0	0	0
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FISHES	24	0	0	2	0
MOLLUSCS	14	0	0	0	0
PLANTS	11	0	0	0	0
All	65	0	0	2	0

Threatened species (CR+EN+VU)

Details of threatened freshwater species present in selected sub-basins. For the full IUCN Red List please refer to the associated csv in the report folder.

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Wallago attu		FISHES	VU	Decreasing	Freshwater
Bagarius yarrelli		FISHES	VU	Decreasing	Freshwater

Migratory Species

Details of migratory freshwater species present in selected sub-basins. For the full IUCN Red List please refer to the associated csv in the report folder.

Species Name	Common Name	Taxonomic Group	IUCN Category	Movement Pattern
Anax ephippiger	Vagrant Emperor	ODONATES	LC or LR/lc	Full Migrant
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Arius arius	Threadfin Sea Catfish	FISHES	LC or LR/lc	Full Migrant
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Silonia silondia	Silong Catfish	FISHES	LC or LR/lc	Full Migrant
Ischnura aurora	Gossamer Damselfly	ODONATES	LC or LR/lc	Full Migrant
Mystus gulio		FISHES	LC or LR/lc	Altitudinal Migrant

Upstream 0.01 to 40

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Upstream 40.01 to 50

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Upstream 50.01 to 70

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Upstream beyond 70

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Downstream -0.01 to -50

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Downstream -50.01 to -100

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Downstream -100.01 to -150

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Downstream beyond -150

Note: there are no sub-basins in this range. This could be either because the previous category includes the most upstream sub-basins in the catchment, or because the specified distance does not extend beyond the sub-basins in the previous category.

Recommended citation

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Annex X – IBAT Proximity Reports

Integrated Biodiversity Assessment Tool

PROXIMITY REPORT
MALIR EXPRESS WAY

Country: Pakistan

Location: [25, 67.3]

Date of analysis: 18 March 2021 (GMT)

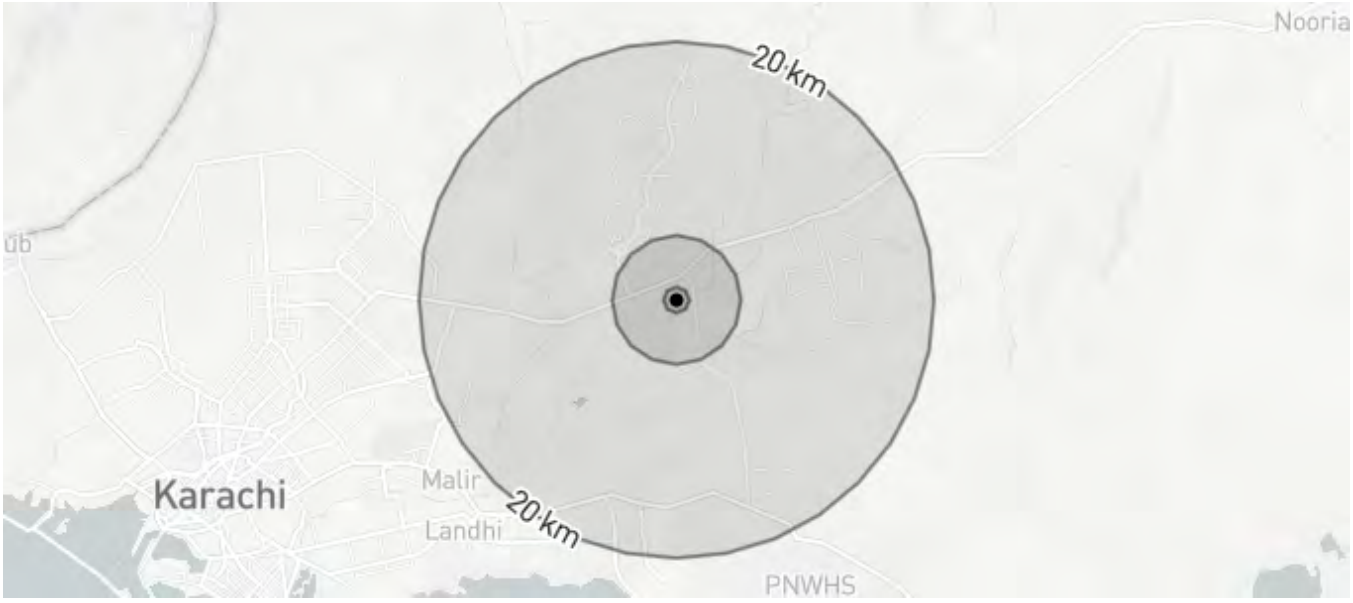
Buffers applied: 1 km | 5 km | 20 km

Generated by: Shazia Shahid

Organisation: ADB

Overlaps with:

Protected Areas	2
Key Biodiversity Areas	1
IUCN Red List	118



Displaying project location and buffers: 1 km, 5 km, 20 km

About this report

This report presents the results of [1400-14826] proximity analysis to identify the biodiversity features and species which are located within the following buffers: 1 km, 5 km, 20 km.

This report is one part of a package generated by IBAT on 18 March 2021 (GMT) that includes full list of all species, protected areas, Key Biodiversity Areas in CSV format, maps showing the area of interest in relation to these features, and a 'How to read IBAT reports' document.

WARNING: IBAT aims to provide the most up-to-date and accurate information available at the time of analysis. There is however a possibility of incomplete, incorrect or out-of-date information. All findings in this report must be supported by further desktop review, consultation with experts and/or on-the-ground field assessment. Please consult IBAT for any additional disclaimers or recommendations applicable to the information used to generate this report.

Please note, sensitive species data are currently not included in IBAT reports in line with the Sensitive Data Access Restrictions Policy for the IUCN Red List. This relates to sensitive Threatened species and KBAs triggered by sensitive species.

Data used to generate this report

- UNEP-WCMC and IUCN, 2021. Protected Planet: The World Database on Protected Areas (WDPA)[On-line], Cambridge, UK: UNEP-WCMC and IUCN. Available at: www.protectedplanet.net - March 2021.
- BirdLife International (on behalf of the KBA Partnership), 2020. Key Biodiversity Areas - October 2020.
- IUCN, 2021. IUCN Red List of Threatened Species - January 2021.

Protected Areas

The following protected areas are found within 1 km, 5 km, 20 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

Area name	Within buffer of
Hab Dam	20 km
Hub (Hab) Dam	20 km

Key Biodiversity Areas

The following key biodiversity areas are found within 1 km, 5 km, 20 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

Area name	Distance
Kirthar National Park (including Hub Dam)	20 km

IUCN Red List of Threatened Species

The following threatened species are potentially found within 50km of the area of interest.

For the full IUCN Red List please refer to the associated csv in the report folder.

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Eretmochelys imbricata	Hawksbill Turtle	REPTILIA	CR	Decreasing	Terrestrial, Marine
Glyphis gangeticus	Ganges Shark	CHONDRICHTHYES	CR	Decreasing	Marine, Freshwater
Carcharhinus hemiodon	Pondicherry Shark	CHONDRICHTHYES	CR	Unknown	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Carcharhinus longimanus	Oceanic Whitetip Shark	CHONDRICHTHYES	CR	Decreasing	Marine
Sphyrna lewini	Scalloped Hammerhead	CHONDRICHTHYES	CR	Decreasing	Marine
Sphyrna mokarran	Great Hammerhead	CHONDRICHTHYES	CR	Decreasing	Marine
Pristis zijsron	Green Sawfish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhina ancylostoma	Bowmouth Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhynchobatus australiae	Bottlenose Wedgefish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhynchobatus laevis	Smoothnose Wedgefish	CHONDRICHTHYES	CR	Decreasing	Marine
Glaucostegus granulatus	Sharpnose Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Glaucostegus obtusus	Widenose Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Glaucostegus halavi	Halavi Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Pristis pristis	Largetooth Sawfish	CHONDRICHTHYES	CR	Decreasing	Marine, Freshwater
Vanellus gregarius	Sociable Lapwing	AVES	CR	Decreasing	Terrestrial
Gyps bengalensis	White-rumped Vulture	AVES	CR	Decreasing	Terrestrial

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Sarcogyps calvus	Red-headed Vulture	AVES	CR	Decreasing	Terrestrial
Maculabatis arabica	Pakistan Whipray	CHONDRICHTHYES	CR	Decreasing	Marine
Balaenoptera musculus	Blue Whale	MAMMALIA	EN	Increasing	Marine
Geoclemys hamiltonii	Spotted Pond Turtle	REPTILIA	EN	Decreasing	Terrestrial, Freshwater
Manis crassicaudata	Indian Pangolin	MAMMALIA	EN	Decreasing	Terrestrial
Rhincodon typus	Whale Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Isurus oxyrinchus	Shortfin Mako	CHONDRICHTHYES	EN	Decreasing	Marine
Anoxypristis cuspidata	Narrow Sawfish	CHONDRICHTHYES	EN	Decreasing	Marine
Axis porcinus	Hog Deer	MAMMALIA	EN	Decreasing	Terrestrial, Freshwater
Eusphyra blochii	Winghead Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula eregoodoo	Longhorned Pygmy Devil Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Stegostoma tigrinum	Zebra Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula tarapacana	Sicklefin Devilray	CHONDRICHTHYES	EN	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Mobula thurstoni	Bentfin Devilray	CHONDRICHTHYES	EN	Decreasing	Marine
Isurus paucus	Longfin Mako	CHONDRICHTHYES	EN	Decreasing	Marine
Parasimplastrea sheppardi		ANTHOZOA	EN	Decreasing	Marine
Mobula kuhlii	Shortfin Devilray	CHONDRICHTHYES	EN	Decreasing	Marine
Maculabatis gerrardi	Whitespotted Whipray	CHONDRICHTHYES	EN	Decreasing	Marine
Lamiopsis temminckii	Broadfin Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Alopias pelagicus	Pelagic Thresher	CHONDRICHTHYES	EN	Decreasing	Marine
Holothuria scabra	Golden Sandfish	HOLOTHUROIDEA	EN	Decreasing	Marine
Thelenota ananas	Prickly Redfish	HOLOTHUROIDEA	EN	Decreasing	Marine
Mobula birostris	Giant Manta Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Oxyura leucocephala	White-headed Duck	AVES	EN	Decreasing	Terrestrial, Freshwater
Sypheotides indicus	Lesser Florican	AVES	EN	Decreasing	Terrestrial
Calidris tenuirostris	Great Knot	AVES	EN	Decreasing	Terrestrial, Marine
Rynchops albicollis	Indian Skimmer	AVES	EN	Decreasing	Terrestrial, Freshwater

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Sterna acuticauda	Black-bellied Tern	AVES	EN	Decreasing	Terrestrial, Freshwater
Haliaeetus leucoryphus	Pallas's Fish-eagle	AVES	EN	Decreasing	Terrestrial, Freshwater
Neophron percnopterus	Egyptian Vulture	AVES	EN	Decreasing	Terrestrial, Freshwater
Aquila nipalensis	Steppe Eagle	AVES	EN	Decreasing	Terrestrial
Falco cherrug	Saker Falcon	AVES	EN	Decreasing	Terrestrial, Marine, Freshwater
Leptoptilos dubius	Greater Adjutant	AVES	EN	Decreasing	Terrestrial, Freshwater
Argyrosomus japonicus	Dusky Meagre	ACTINOPTERYGII	EN	Decreasing	Marine
Carcharhinus dussumieri	Whitecheek Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Sousa plumbea	Indian Ocean Humpback Dolphin	MAMMALIA	EN	Decreasing	Marine
Aetomylaeus milvus	Ocellate Eagle Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Pateobatis bleekeri	Bleeker's Whipray	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula mobular	Spinetail Devil Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Carcharhinus plumbeus	Sandbar Shark	CHONDRICHTHYES	VU	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Carcharias taurus	Sand Tiger Shark	CHONDRICHTHYES	VU	Unknown	Marine
Carcharodon carcharias	White Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Caretta caretta	Loggerhead Turtle	REPTILIA	VU	Decreasing	Terrestrial, Marine
Crocodylus palustris	Mugger	REPTILIA	VU	Stable	Terrestrial, Freshwater
Lepidochelys olivacea	Olive Ridley	REPTILIA	VU	Decreasing	Terrestrial, Marine
Panthera pardus	Leopard	MAMMALIA	VU	Decreasing	Terrestrial
Prionailurus viverrinus	Fishing Cat	MAMMALIA	VU	Decreasing	Terrestrial, Freshwater
Ursus thibetanus	Asiatic Black Bear	MAMMALIA	VU	Decreasing	Terrestrial
Alopias vulpinus	Common Thresher	CHONDRICHTHYES	VU	Decreasing	Marine
Carcharhinus falciformis	Silky Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Carcharhinus melanopterus	Blacktip Reef Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Triaenodon obesus	Whitetip Reef Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Sphyrna zygaena	Smooth Hammerhead	CHONDRICHTHYES	VU	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Urogymnus asperrimus	Porcupine Ray	CHONDRICHTHYES	VU	Decreasing	Marine
Hippocampus kelloggi	Great Seahorse	ACTINOPTERYGII	VU	Decreasing	Marine
Physeter macrocephalus	Sperm Whale	MAMMALIA	VU	Unknown	Marine
Chiloscyllium indicum	Slender Bambooshark	CHONDRICHTHYES	VU	Decreasing	Marine
Chiloscyllium griseum	Grey Bamboo Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Negaprion acutidens	Sharptooth Lemon Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Rhizoprionodon acutus	Milk Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Hemipristis elongata	Snaggletooth Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Epinephelus fuscoguttatus	Brown-marbled Grouper	ACTINOPTERYGII	VU	Decreasing	Marine
Rhinoptera javanica	Javanese Cownose Ray	CHONDRICHTHYES	VU	Unknown	Marine
Taeniurops meyeni	Blotched Fantail Ray	CHONDRICHTHYES	VU	Decreasing	Marine
Pavona venosa		ANTHOZOA	VU	Unknown	Marine
Montipora stilosa		ANTHOZOA	VU	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Pavona decussata	Cactus Coral	ANTHOZOA	VU	Unknown	Marine
Heliopora coerulea	Blue Coral	ANTHOZOA	VU	Decreasing	Marine
Acropora pharaonis		ANTHOZOA	VU	Decreasing	Marine
Acropora horrida		ANTHOZOA	VU	Decreasing	Marine
Galaxea astreata		ANTHOZOA	VU	Unknown	Marine
Physogyra lichtensteini		ANTHOZOA	VU	Unknown	Marine
Anomastraea irregularis		ANTHOZOA	VU	Decreasing	Marine
Turbinaria peltata		ANTHOZOA	VU	Unknown	Marine
Pavona cactus		ANTHOZOA	VU	Unknown	Marine
Pavona diffluens		ANTHOZOA	VU	Unknown	Marine
Turbinaria reniformis		ANTHOZOA	VU	Unknown	Marine
Narcine lingula	Chinese Numbfish	CHONDRICHTHYES	VU	Decreasing	Marine
Himantura uarnak	Reticulate Whipray	CHONDRICHTHYES	VU	Decreasing	Marine
Chaenogaleus macrostoma	Hooktooth Shark	CHONDRICHTHYES	VU	Unknown	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Alopias superciliosus	Bigeye Thresher	CHONDRICHTHYES	VU	Decreasing	Marine
Wallago attu		ACTINOPTERYGII	VU	Decreasing	Freshwater
Bagarius yarrelli		ACTINOPTERYGII	VU	Decreasing	Freshwater
Stichopus herrmanni	Curryfish	HOLOTHUROIDEA	VU	Decreasing	Marine
Mola mola	Ocean Sunfish	ACTINOPTERYGII	VU	Decreasing	Marine
Mobula alfredi	Reef Manta Ray	CHONDRICHTHYES	VU	Decreasing	Marine
Neophocaena phocaenoides	Indo-Pacific Finless Porpoise	MAMMALIA	VU	Decreasing	Marine
Holothuria fuscogilva		HOLOTHUROIDEA	VU	Decreasing	Marine
Anacyclus pyrethrum	Atlas Daisy	MAGNOLIOPSIDA	VU	Decreasing	Terrestrial
Trachurus indicus	Arabian Scad	ACTINOPTERYGII	VU	Decreasing	Marine
Marmaronetta angustirostris	Marbled Teal	AVES	VU	Decreasing	Terrestrial, Marine, Freshwater
Aythya ferina	Common Pochard	AVES	VU	Decreasing	Terrestrial, Marine, Freshwater
Columba eversmanni	Yellow-eyed Pigeon	AVES	VU	Decreasing	Terrestrial, Freshwater

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Sterna aurantia	River Tern	AVES	VU	Decreasing	Terrestrial, Marine, Freshwater
Clanga clanga	Greater Spotted Eagle	AVES	VU	Decreasing	Terrestrial, Freshwater
Aquila rapax	Tawny Eagle	AVES	VU	Decreasing	Terrestrial, Freshwater
Aquila heliaca	Eastern Imperial Eagle	AVES	VU	Decreasing	Terrestrial, Freshwater
Chlamydotis macqueenii	Asian Houbara	AVES	VU	Decreasing	Terrestrial
Aetobatus ocellatus	Spotted Eagle Ray	CHONDRICHTHYES	VU	Decreasing	Marine
Omobranchus mekranensis	Mekran Blenny	ACTINOPTERYGII	VU	Unknown	Marine
Ovis vignei	Urial	MAMMALIA	VU	Decreasing	Terrestrial
Aetomylaeus nichofii	Banded Eagle Ray	CHONDRICHTHYES	VU	Decreasing	Marine

Recommended citation

IBAT Proximity Report. Generated under licence 1400-14826 from the Integrated Biodiversity Assessment Tool on 18 March 2021 (GMT). www.ibat-alliance.org

How to use this report

This report provides an indication of the potential biodiversity-related features - protected areas, key biodiversity areas and species - close to the specified location. It provides an early indication of potential biodiversity concerns, and can provide valuable guidance in making decisions. For example, this information can be helpful when assessing the potential environmental risk and impact of a site, categorising investments/projects, preparing the terms of reference for an impact assessment, focusing attention on key species of conservation concern and sites of known conservation value, and reviewing the results of an impact assessment.

The report does not provide details of potential indirect, downstream or cumulative impacts. Furthermore, the report should be regarded as a "first-step", providing a set of conservation values sourced from global data sets, and is not a substitute for further investigation and due diligence, especially concerning national and/or local conservation priorities.

Integrated Biodiversity Assessment Tool

PROXIMITY REPORT

MALIR 2

Country: Pakistan

Location: [24.9, 67.4]

Date of analysis: 18 March 2021 (GMT)

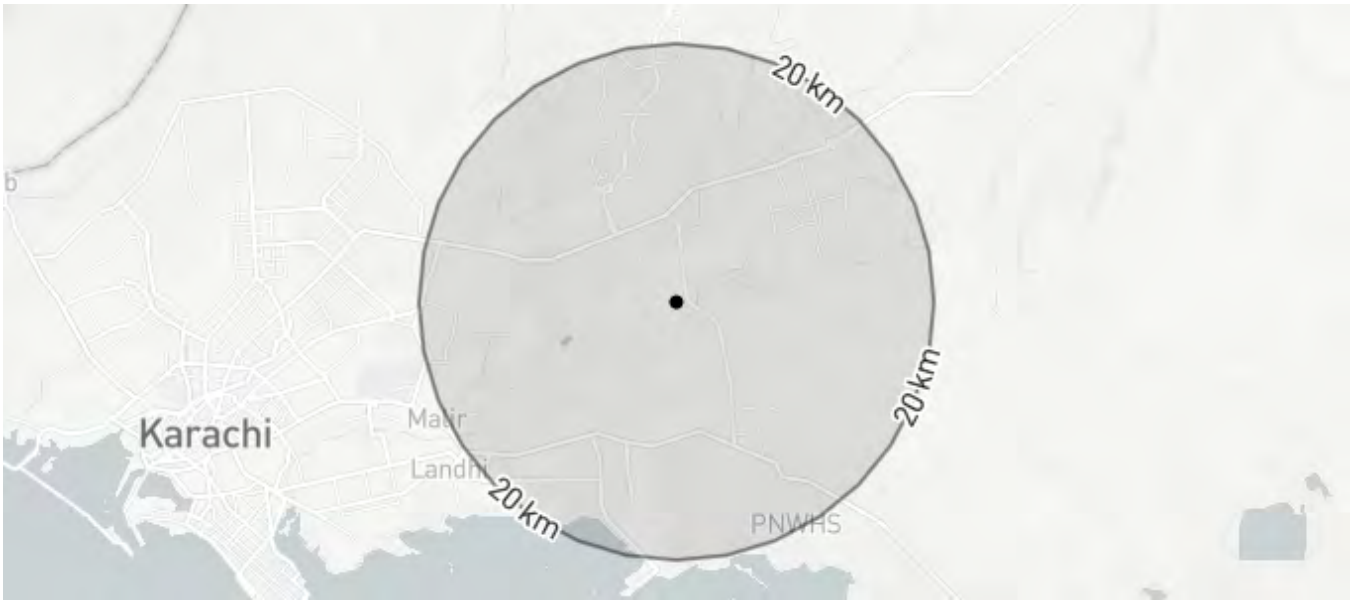
Buffers applied: 20 km

Generated by: Shazia Shahid

Organisation: ADB

Overlaps with:

Protected Areas	2
Key Biodiversity Areas	0
IUCN Red List	118



Displaying project location and buffers: 20 km

About this report

This report presents the results of [1400-14829] proximity analysis to identify the biodiversity features and species which are located within the following buffers: 20 km.

This report is one part of a package generated by IBAT on 18 March 2021 (GMT) that includes full list of all species, protected areas, Key Biodiversity Areas in CSV format, maps showing the area of interest in relation to these features, and a 'How to read IBAT reports' document.

WARNING: IBAT aims to provide the most up-to-date and accurate information available at the time of analysis. There is however a possibility of incomplete, incorrect or out-of-date information. All findings in this report must be supported by further desktop review, consultation with experts and/or on-the-ground field assessment. Please consult IBAT for any additional disclaimers or recommendations applicable to the information used to generate this report.

Please note, sensitive species data are currently not included in IBAT reports in line with the Sensitive Data Access Restrictions Policy for the IUCN Red List. This relates to sensitive Threatened species and KBAs triggered by sensitive species.

Data used to generate this report

- UNEP-WCMC and IUCN, 2021. Protected Planet: The World Database on Protected Areas (WDPA)[On-line], Cambridge, UK: UNEP-WCMC and IUCN. Available at: www.protectedplanet.net - March 2021.
- BirdLife International (on behalf of the KBA Partnership), 2020. Key Biodiversity Areas - October 2020.
- IUCN, 2021. IUCN Red List of Threatened Species - January 2021.

Protected Areas

The following protected areas are found within 20 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

Area name	Within buffer of
Hab Dam	20 km
Hub (Hab) Dam	20 km

Key Biodiversity Areas

The following key biodiversity areas are found within 20 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

No KBAs within buffer distance

IUCN Red List of Threatened Species

The following threatened species are potentially found within 50km of the area of interest.

For the full IUCN Red List please refer to the associated csv in the report folder.

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Eretmochelys imbricata	Hawksbill Turtle	REPTILIA	CR	Decreasing	Terrestrial, Marine
Glyphis gangeticus	Ganges Shark	CHONDRICHTHYES	CR	Decreasing	Marine, Freshwater
Carcharhinus hemiodon	Pondicherry Shark	CHONDRICHTHYES	CR	Unknown	Marine
Carcharhinus longimanus	Oceanic Whitetip Shark	CHONDRICHTHYES	CR	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Sphyrna lewini	Scalloped Hammerhead	CHONDRICHTHYES	CR	Decreasing	Marine
Sphyrna mokarran	Great Hammerhead	CHONDRICHTHYES	CR	Decreasing	Marine
Pristis zijsron	Green Sawfish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhina ancylostoma	Bowmouth Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhynchobatus australiae	Bottlenose Wedgefish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhynchobatus laevis	Smoothnose Wedgefish	CHONDRICHTHYES	CR	Decreasing	Marine
Glaucostegus granulatus	Sharpnose Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Glaucostegus obtusus	Widenose Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Glaucostegus halavi	Halavi Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Pristis pristis	Largetooth Sawfish	CHONDRICHTHYES	CR	Decreasing	Marine, Freshwater
Vanellus gregarius	Sociable Lapwing	AVES	CR	Decreasing	Terrestrial
Gyps bengalensis	White-rumped Vulture	AVES	CR	Decreasing	Terrestrial
Sarcogyps calvus	Red-headed Vulture	AVES	CR	Decreasing	Terrestrial

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Maculabatis arabica	Pakistan Whipray	CHONDRICHTHYES	CR	Decreasing	Marine
Balaenoptera musculus	Blue Whale	MAMMALIA	EN	Increasing	Marine
Geoclemys hamiltonii	Spotted Pond Turtle	REPTILIA	EN	Decreasing	Terrestrial, Freshwater
Manis crassicaudata	Indian Pangolin	MAMMALIA	EN	Decreasing	Terrestrial
Rhincodon typus	Whale Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Isurus oxyrinchus	Shortfin Mako	CHONDRICHTHYES	EN	Decreasing	Marine
Anoxypristis cuspidata	Narrow Sawfish	CHONDRICHTHYES	EN	Decreasing	Marine
Axis porcinus	Hog Deer	MAMMALIA	EN	Decreasing	Terrestrial, Freshwater
Eusphyra blochii	Winghead Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula eregoodoo	Longhorned Pygmy Devil Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Stegostoma tigrinum	Zebra Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula tarapacana	Sicklefin Devilray	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula thurstoni	Bentfin Devilray	CHONDRICHTHYES	EN	Decreasing	Marine
Isurus paucus	Longfin Mako	CHONDRICHTHYES	EN	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Parasimplastrea sheppardi		ANTHOZOA	EN	Decreasing	Marine
Mobula kuhlii	Shortfin Devilray	CHONDRICHTHYES	EN	Decreasing	Marine
Maculabatis gerrardi	Whitespotted Whipray	CHONDRICHTHYES	EN	Decreasing	Marine
Lamiopsis temminckii	Broadfin Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Alopias pelagicus	Pelagic Thresher	CHONDRICHTHYES	EN	Decreasing	Marine
Holothuria scabra	Golden Sandfish	HOLOTHUROIDEA	EN	Decreasing	Marine
Thelenota ananas	Prickly Redfish	HOLOTHUROIDEA	EN	Decreasing	Marine
Mobula birostris	Giant Manta Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Oxyura leucocephala	White-headed Duck	AVES	EN	Decreasing	Terrestrial, Freshwater
Sypheotides indicus	Lesser Florican	AVES	EN	Decreasing	Terrestrial
Calidris tenuirostris	Great Knot	AVES	EN	Decreasing	Terrestrial, Marine
Rynchops albicollis	Indian Skimmer	AVES	EN	Decreasing	Terrestrial, Freshwater
Sterna acuticauda	Black-bellied Tern	AVES	EN	Decreasing	Terrestrial, Freshwater

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Haliaeetus leucoryphus	Pallas's Fish-eagle	AVES	EN	Decreasing	Terrestrial, Freshwater
Neophron percnopterus	Egyptian Vulture	AVES	EN	Decreasing	Terrestrial, Freshwater
Aquila nipalensis	Steppe Eagle	AVES	EN	Decreasing	Terrestrial
Falco cherrug	Saker Falcon	AVES	EN	Decreasing	Terrestrial, Marine, Freshwater
Leptoptilos dubius	Greater Adjutant	AVES	EN	Decreasing	Terrestrial, Freshwater
Argyrosomus japonicus	Dusky Meagre	ACTINOPTERYGII	EN	Decreasing	Marine
Carcharhinus dussumieri	Whitecheek Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Sousa plumbea	Indian Ocean Humpback Dolphin	MAMMALIA	EN	Decreasing	Marine
Aetomylaeus milvus	Ocellate Eagle Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Pateobatis bleekeri	Bleeker's Whipray	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula mobular	Spinetail Devil Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Carcharhinus plumbeus	Sandbar Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Carcharias taurus	Sand Tiger Shark	CHONDRICHTHYES	VU	Unknown	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Carcharodon carcharias	White Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Caretta caretta	Loggerhead Turtle	REPTILIA	VU	Decreasing	Terrestrial, Marine
Crocodylus palustris	Mugger	REPTILIA	VU	Stable	Terrestrial, Freshwater
Lepidochelys olivacea	Olive Ridley	REPTILIA	VU	Decreasing	Terrestrial, Marine
Panthera pardus	Leopard	MAMMALIA	VU	Decreasing	Terrestrial
Prionailurus viverrinus	Fishing Cat	MAMMALIA	VU	Decreasing	Terrestrial, Freshwater
Ursus thibetanus	Asiatic Black Bear	MAMMALIA	VU	Decreasing	Terrestrial
Alopias vulpinus	Common Thresher	CHONDRICHTHYES	VU	Decreasing	Marine
Carcharhinus falciformis	Silky Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Carcharhinus melanopterus	Blacktip Reef Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Triaenodon obesus	Whitetip Reef Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Sphyrna zygaena	Smooth Hammerhead	CHONDRICHTHYES	VU	Decreasing	Marine
Urogymnus asperrimus	Porcupine Ray	CHONDRICHTHYES	VU	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Hippocampus kelloggi	Great Seahorse	ACTINOPTERYGII	VU	Decreasing	Marine
Physeter macrocephalus	Sperm Whale	MAMMALIA	VU	Unknown	Marine
Chiloscyllium indicum	Slender Bambooshark	CHONDRICHTHYES	VU	Decreasing	Marine
Chiloscyllium griseum	Grey Bamboo Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Negaprion acutidens	Sharptooth Lemon Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Rhizoprionodon acutus	Milk Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Hemipristis elongata	Snaggletooth Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Epinephelus fuscoguttatus	Brown-marbled Grouper	ACTINOPTERYGII	VU	Decreasing	Marine
Rhinoptera javanica	Javanese Cownose Ray	CHONDRICHTHYES	VU	Unknown	Marine
Taeniurops meyeni	Blotched Fantail Ray	CHONDRICHTHYES	VU	Decreasing	Marine
Pavona venosa		ANTHOZOA	VU	Unknown	Marine
Montipora stilosa		ANTHOZOA	VU	Decreasing	Marine
Pavona decussata	Cactus Coral	ANTHOZOA	VU	Unknown	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Heliopora coerulea	Blue Coral	ANTHOZOA	VU	Decreasing	Marine
Acropora pharaonis		ANTHOZOA	VU	Decreasing	Marine
Acropora horrida		ANTHOZOA	VU	Decreasing	Marine
Galaxea astreata		ANTHOZOA	VU	Unknown	Marine
Physogyra lichtensteini		ANTHOZOA	VU	Unknown	Marine
Anomastraea irregularis		ANTHOZOA	VU	Decreasing	Marine
Turbinaria peltata		ANTHOZOA	VU	Unknown	Marine
Pavona cactus		ANTHOZOA	VU	Unknown	Marine
Pavona diffluens		ANTHOZOA	VU	Unknown	Marine
Turbinaria reniformis		ANTHOZOA	VU	Unknown	Marine
Narcine lingula	Chinese Numbfish	CHONDRICHTHYES	VU	Decreasing	Marine
Himantura uarnak	Reticulate Whipray	CHONDRICHTHYES	VU	Decreasing	Marine
Chaenogaleus macrostoma	Hooktooth Shark	CHONDRICHTHYES	VU	Unknown	Marine
Alopias superciliosus	Bigeye Thresher	CHONDRICHTHYES	VU	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Wallago attu		ACTINOPTERYGII	VU	Decreasing	Freshwater
Bagarius yarrelli		ACTINOPTERYGII	VU	Decreasing	Freshwater
Stichopus herrmanni	Curryfish	HOLOTHUROIDEA	VU	Decreasing	Marine
Mola mola	Ocean Sunfish	ACTINOPTERYGII	VU	Decreasing	Marine
Mobula alfredi	Reef Manta Ray	CHONDRICHTHYES	VU	Decreasing	Marine
Neophocaena phocaenoides	Indo-Pacific Finless Porpoise	MAMMALIA	VU	Decreasing	Marine
Holothuria fuscogilva		HOLOTHUROIDEA	VU	Decreasing	Marine
Anacyclus pyrethrum	Atlas Daisy	MAGNOLIOPSIDA	VU	Decreasing	Terrestrial
Trachurus indicus	Arabian Scad	ACTINOPTERYGII	VU	Decreasing	Marine
Marmaronetta angustirostris	Marbled Teal	AVES	VU	Decreasing	Terrestrial, Marine, Freshwater
Aythya ferina	Common Pochard	AVES	VU	Decreasing	Terrestrial, Marine, Freshwater
Columba eversmanni	Yellow-eyed Pigeon	AVES	VU	Decreasing	Terrestrial, Freshwater
Sterna aurantia	River Tern	AVES	VU	Decreasing	Terrestrial, Marine, Freshwater

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Clanga clanga	Greater Spotted Eagle	AVES	VU	Decreasing	Terrestrial, Freshwater
Aquila rapax	Tawny Eagle	AVES	VU	Decreasing	Terrestrial, Freshwater
Aquila heliaca	Eastern Imperial Eagle	AVES	VU	Decreasing	Terrestrial, Freshwater
Chlamydotis macqueenii	Asian Houbara	AVES	VU	Decreasing	Terrestrial
Aetobatus ocellatus	Spotted Eagle Ray	CHONDRICHTHYES	VU	Decreasing	Marine
Omobranchus mekranensis	Mekran Blenny	ACTINOPTERYGII	VU	Unknown	Marine
Ovis vignei	Urial	MAMMALIA	VU	Decreasing	Terrestrial
Aetomylaeus nichofii	Banded Eagle Ray	CHONDRICHTHYES	VU	Decreasing	Marine

Recommended citation

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How to use this report

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The report does not provide details of potential indirect, downstream or cumulative impacts. Furthermore, the report should be regarded as a "first-step", providing a set of conservation values sourced from global data sets, and is not a substitute for further investigation and due diligence, especially concerning national and/or local conservation priorities.

Integrated Biodiversity Assessment Tool

PROXIMITY REPORT

MALIR 3

Country: Pakistan

Location: [24.8, 67.1]

Date of analysis: 18 March 2021 (GMT)

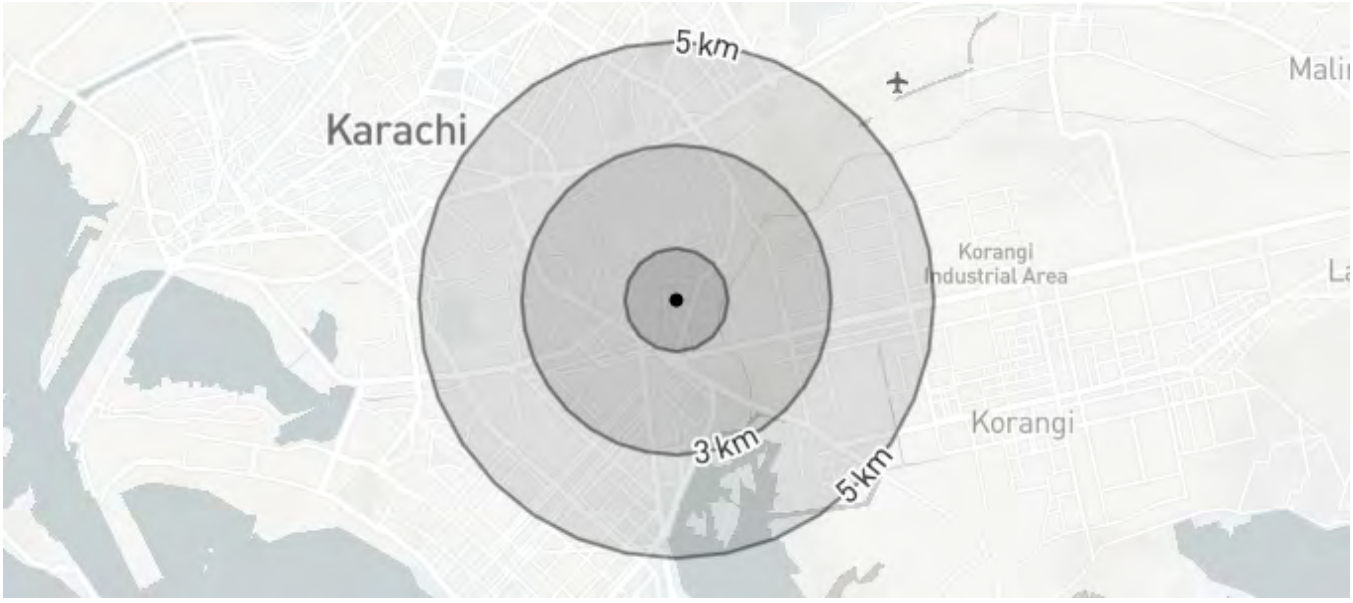
Buffers applied: 1 km | 3 km | 5 km

Generated by: Shazia Shahid

Organisation: ADB

Overlaps with:

Protected Areas	0
Key Biodiversity Areas	0
IUCN Red List	113



Displaying project location and buffers: 1 km, 3 km, 5 km

About this report

This report presents the results of [1400-14830] proximity analysis to identify the biodiversity features and species which are located within the following buffers: 1 km, 3 km, 5 km.

This report is one part of a package generated by IBAT on 18 March 2021 (GMT) that includes full list of all species, protected areas, Key Biodiversity Areas in CSV format, maps showing the area of interest in relation to these features, and a 'How to read IBAT reports' document.

WARNING: IBAT aims to provide the most up-to-date and accurate information available at the time of analysis. There is however a possibility of incomplete, incorrect or out-of-date information. All findings in this report must be supported by further desktop review, consultation with experts and/or on-the-ground field assessment. Please consult IBAT for any additional disclaimers or recommendations applicable to the information used to generate this report.

Please note, sensitive species data are currently not included in IBAT reports in line with the Sensitive Data Access Restrictions Policy for the IUCN Red List. This relates to sensitive Threatened species and KBAs triggered by sensitive species.

Data used to generate this report

- UNEP-WCMC and IUCN, 2021. Protected Planet: The World Database on Protected Areas (WDPA)[On-line], Cambridge, UK: UNEP-WCMC and IUCN. Available at: www.protectedplanet.net - March 2021.
- BirdLife International (on behalf of the KBA Partnership), 2020. Key Biodiversity Areas - October 2020.
- IUCN, 2021. IUCN Red List of Threatened Species - January 2021.

Protected Areas

The following protected areas are found within 1 km, 3 km, 5 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

No protected areas within buffer distance

Key Biodiversity Areas

The following key biodiversity areas are found within 1 km, 3 km, 5 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

No KBAs within buffer distance

IUCN Red List of Threatened Species

The following threatened species are potentially found within 50km of the area of interest.

For the full IUCN Red List please refer to the associated csv in the report folder.

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Eretmochelys imbricata	Hawksbill Turtle	REPTILIA	CR	Decreasing	Terrestrial, Marine
Glyphis gangeticus	Ganges Shark	CHONDRICHTHYES	CR	Decreasing	Marine, Freshwater
Carcharhinus hemiodon	Pondicherry Shark	CHONDRICHTHYES	CR	Unknown	Marine
Carcharhinus longimanus	Oceanic Whitetip Shark	CHONDRICHTHYES	CR	Decreasing	Marine
Sphyrna lewini	Scalloped Hammerhead	CHONDRICHTHYES	CR	Decreasing	Marine
Sphyrna mokarran	Great Hammerhead	CHONDRICHTHYES	CR	Decreasing	Marine
Pristis zijsron	Green Sawfish	CHONDRICHTHYES	CR	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Rhina ancylostoma	Bowmouth Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhynchobatus australiae	Bottlenose Wedgefish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhynchobatus laevis	Smoothnose Wedgefish	CHONDRICHTHYES	CR	Decreasing	Marine
Glaucostegus granulatus	Sharpnose Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Glaucostegus obtusus	Widenose Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Glaucostegus halavi	Halavi Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Pristis pristis	Largetooth Sawfish	CHONDRICHTHYES	CR	Decreasing	Marine, Freshwater
Vanellus gregarius	Sociable Lapwing	AVES	CR	Decreasing	Terrestrial
Gyps bengalensis	White-rumped Vulture	AVES	CR	Decreasing	Terrestrial
Sarcogyps calvus	Red-headed Vulture	AVES	CR	Decreasing	Terrestrial
Maculabatis arabica	Pakistan Whipray	CHONDRICHTHYES	CR	Decreasing	Marine
Balaenoptera musculus	Blue Whale	MAMMALIA	EN	Increasing	Marine
Manis crassicaudata	Indian Pangolin	MAMMALIA	EN	Decreasing	Terrestrial

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Rhincodon typus	Whale Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Isurus oxyrinchus	Shortfin Mako	CHONDRICHTHYES	EN	Decreasing	Marine
Anoxypristis cuspidata	Narrow Sawfish	CHONDRICHTHYES	EN	Decreasing	Marine
Axis porcinus	Hog Deer	MAMMALIA	EN	Decreasing	Terrestrial, Freshwater
Eusphyra blochii	Winghead Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula eregoodoo	Longhorned Pygmy Devil Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Stegostoma tigrinum	Zebra Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula tarapacana	Sicklefin Devilray	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula thurstoni	Bentfin Devilray	CHONDRICHTHYES	EN	Decreasing	Marine
Isurus paucus	Longfin Mako	CHONDRICHTHYES	EN	Decreasing	Marine
Parasimplastrea sheppardi		ANTHOZOA	EN	Decreasing	Marine
Mobula kuhlii	Shortfin Devilray	CHONDRICHTHYES	EN	Decreasing	Marine
Maculabatis gerrardi	Whitespotted Whipray	CHONDRICHTHYES	EN	Decreasing	Marine
Lamiopsis temminckii	Broadfin Shark	CHONDRICHTHYES	EN	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Alopias pelagicus	Pelagic Thresher	CHONDRICHTHYES	EN	Decreasing	Marine
Holothuria scabra	Golden Sandfish	HOLOTHUROIDEA	EN	Decreasing	Marine
Thelenota ananas	Prickly Redfish	HOLOTHUROIDEA	EN	Decreasing	Marine
Mobula birostris	Giant Manta Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Sypheotides indicus	Lesser Florican	AVES	EN	Decreasing	Terrestrial
Calidris tenuirostris	Great Knot	AVES	EN	Decreasing	Terrestrial, Marine
Haliaeetus leucoryphus	Pallas's Fish-eagle	AVES	EN	Decreasing	Terrestrial, Freshwater
Neophron percnopterus	Egyptian Vulture	AVES	EN	Decreasing	Terrestrial, Freshwater
Aquila nipalensis	Steppe Eagle	AVES	EN	Decreasing	Terrestrial
Falco cherrug	Saker Falcon	AVES	EN	Decreasing	Terrestrial, Marine, Freshwater
Leptoptilos dubius	Greater Adjutant	AVES	EN	Decreasing	Terrestrial, Freshwater
Argyrosomus japonicus	Dusky Meagre	ACTINOPTERYGII	EN	Decreasing	Marine
Carcharhinus dussumieri	Whitecheek Shark	CHONDRICHTHYES	EN	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Sousa plumbea	Indian Ocean Humpback Dolphin	MAMMALIA	EN	Decreasing	Marine
Aetomylaeus milvus	Ocellate Eagle Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Pateobatis bleekeri	Bleeker's Whipray	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula mobular	Spinetail Devil Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Carcharhinus plumbeus	Sandbar Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Carcharias taurus	Sand Tiger Shark	CHONDRICHTHYES	VU	Unknown	Marine
Carcharodon carcharias	White Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Caretta caretta	Loggerhead Turtle	REPTILIA	VU	Decreasing	Terrestrial, Marine
Crocodylus palustris	Mugger	REPTILIA	VU	Stable	Terrestrial, Freshwater
Lepidochelys olivacea	Olive Ridley	REPTILIA	VU	Decreasing	Terrestrial, Marine
Panthera pardus	Leopard	MAMMALIA	VU	Decreasing	Terrestrial
Prionailurus viverrinus	Fishing Cat	MAMMALIA	VU	Decreasing	Terrestrial, Freshwater
Ursus thibetanus	Asiatic Black Bear	MAMMALIA	VU	Decreasing	Terrestrial

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Alopias vulpinus	Common Thresher	CHONDRICHTHYES	VU	Decreasing	Marine
Carcharhinus falciformis	Silky Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Carcharhinus melanopterus	Blacktip Reef Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Triaenodon obesus	Whitetip Reef Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Sphyrna zygaena	Smooth Hammerhead	CHONDRICHTHYES	VU	Decreasing	Marine
Urogymnus asperrimus	Porcupine Ray	CHONDRICHTHYES	VU	Decreasing	Marine
Hippocampus kelloggi	Great Seahorse	ACTINOPTERYGII	VU	Decreasing	Marine
Physeter macrocephalus	Sperm Whale	MAMMALIA	VU	Unknown	Marine
Chiloscyllium indicum	Slender Bambooshark	CHONDRICHTHYES	VU	Decreasing	Marine
Chiloscyllium griseum	Grey Bamboo Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Negaprion acutidens	Sharptooth Lemon Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Rhizoprionodon acutus	Milk Shark	CHONDRICHTHYES	VU	Decreasing	Marine
Hemipristis elongata	Snaggletooth Shark	CHONDRICHTHYES	VU	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Epinephelus fuscoguttatus	Brown-marbled Grouper	ACTINOPTERYGII	VU	Decreasing	Marine
Rhinoptera javanica	Javanese Cownose Ray	CHONDRICHTHYES	VU	Unknown	Marine
Taeniurops meyeni	Blotched Fantail Ray	CHONDRICHTHYES	VU	Decreasing	Marine
Pavona venosa		ANTHOZOA	VU	Unknown	Marine
Montipora stilosa		ANTHOZOA	VU	Decreasing	Marine
Pavona decussata	Cactus Coral	ANTHOZOA	VU	Unknown	Marine
Heliopora coerulea	Blue Coral	ANTHOZOA	VU	Decreasing	Marine
Acropora pharaonis		ANTHOZOA	VU	Decreasing	Marine
Acropora horrida		ANTHOZOA	VU	Decreasing	Marine
Galaxea astreata		ANTHOZOA	VU	Unknown	Marine
Physogyra lichtensteini		ANTHOZOA	VU	Unknown	Marine
Anomastraea irregularis		ANTHOZOA	VU	Decreasing	Marine
Turbinaria peltata		ANTHOZOA	VU	Unknown	Marine
Pavona cactus		ANTHOZOA	VU	Unknown	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Pavona diffluens		ANTHOZOA	VU	Unknown	Marine
Turbinaria reniformis		ANTHOZOA	VU	Unknown	Marine
Narcine lingula	Chinese Numbfish	CHONDRICHTHYES	VU	Decreasing	Marine
Himantura uarnak	Reticulate Whipray	CHONDRICHTHYES	VU	Decreasing	Marine
Chaenogaleus macrostoma	Hooktooth Shark	CHONDRICHTHYES	VU	Unknown	Marine
Alopias superciliosus	Bigeye Thresher	CHONDRICHTHYES	VU	Decreasing	Marine
Wallago attu		ACTINOPTERYGII	VU	Decreasing	Freshwater
Bagarius yarrelli		ACTINOPTERYGII	VU	Decreasing	Freshwater
Stichopus herrmanni	Curryfish	HOLOTHUROIDEA	VU	Decreasing	Marine
Mola mola	Ocean Sunfish	ACTINOPTERYGII	VU	Decreasing	Marine
Mobula alfredi	Reef Manta Ray	CHONDRICHTHYES	VU	Decreasing	Marine
Neophocaena phocaenoides	Indo-Pacific Finless Porpoise	MAMMALIA	VU	Decreasing	Marine
Holothuria fuscogilva		HOLOTHUROIDEA	VU	Decreasing	Marine
Anacyclus pyrethrum	Atlas Daisy	MAGNOLIOPSIDA	VU	Decreasing	Terrestrial

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Trachurus indicus	Arabian Scad	ACTINOPTERYGII	VU	Decreasing	Marine
Marmaronetta angustirostris	Marbled Teal	AVES	VU	Decreasing	Terrestrial, Marine, Freshwater
Aythya ferina	Common Pochard	AVES	VU	Decreasing	Terrestrial, Marine, Freshwater
Columba eversmanni	Yellow-eyed Pigeon	AVES	VU	Decreasing	Terrestrial, Freshwater
Sterna aurantia	River Tern	AVES	VU	Decreasing	Terrestrial, Marine, Freshwater
Clanga clanga	Greater Spotted Eagle	AVES	VU	Decreasing	Terrestrial, Freshwater
Aquila rapax	Tawny Eagle	AVES	VU	Decreasing	Terrestrial, Freshwater
Aquila heliaca	Eastern Imperial Eagle	AVES	VU	Decreasing	Terrestrial, Freshwater
Chlamydotis macqueenii	Asian Houbara	AVES	VU	Decreasing	Terrestrial
Aetobatus ocellatus	Spotted Eagle Ray	CHONDRICHTHYES	VU	Decreasing	Marine
Omobranchus mekranensis	Mekran Blenny	ACTINOPTERYGII	VU	Unknown	Marine
Aetomylaeus nichofii	Banded Eagle Ray	CHONDRICHTHYES	VU	Decreasing	Marine

Recommended citation

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How to use this report

This report provides an indication of the potential biodiversity-related features - protected areas, key biodiversity areas and species - close to the specified location. It provides an early indication of potential biodiversity concerns, and can provide valuable guidance in making decisions. For example, this information can be helpful when assessing the potential environmental risk and impact of a site, categorising investments/projects, preparing the terms of reference for an impact assessment, focusing attention on key species of conservation concern and sites of known conservation value, and reviewing the results of an impact assessment.

The report does not provide details of potential indirect, downstream or cumulative impacts. Furthermore, the report should be regarded as a "first-step", providing a set of conservation values sourced from global data sets, and is not a substitute for further investigation and due diligence, especially concerning national and/or local conservation priorities.

Annex XI – Consultations with Locals

CONSULTATIONS WITH LOCAL COMMUNITIES AND PROJECT AFFECTED PERSONS

Sr. No.	Date	Venue	Occupation	Name
1	14-11-2020	Shah Faisal Colony	Driver	Muhammad Riaz
			Retired Govt. Servant	Jaffar Shah
			Mechanic	Javed Ali
			Driver	Nazakat Ali
			Mechanic	Muhammad Bilal
			Driver	Muhammad Riaz
			Retired Govt. Servant	Jaffar Shah
			Mechanic	Javed Ali
			Driver	Nazakat Ali
			Mechanic	Muhammad Bilal
			Retired Govt. Servant	Subhan Khan
			Business Operator	Naseeb Ullah
			Driver	M. Zheer Ullah
			Driver	Muhammad Saleem
			Driver	Arshad Ali
			Shopkeeper	Iqbal Ahmed
			Shopkeeper	Muhammad Aman
			Mechanic	Muhammad Salman
			Labour	Muhammad Ahsan
			Driver	Muhammad Nadeem
			In charge Cricket Ground	Muhammad Raza
			Driver	Muhammad Nadeem

Question Raised by the Participants	Response of the Consultant
• How much is the length of the proposed road and from where is passing? From where the road is starting and ending?	• The participants were briefed about the routes and lengths of the proposed road and its width with the help of design map.
• The road is crossing cricket ground which will damage the ground condition and the structures of the cricket ground. Proposed alignment of the road will affect the sports activities in the ground.	• The affected ground area will be shifted and ply ground will be restored as per precondition before starting construction activates of the road. Proper compensation will be provided against the damage of structures for the reconstruction of all demolished structures Sport activities will not be interrupted.

Sr. No.	Date	Venue	Occupation	Name
• The route of the road has been proposed in front of the residential area where the residents move frequently on the bank of Malir river. Due to construction of the road residential areas will be blocked and due to moment of the local people accidents will happen frequently.				The road route has been prepared away along the river bank at this location no residential structure falls in the ROW of the road. Moreover, the road fence will be installed to reduce the risk of accidents and awareness will be created among the road users and residents of the area.
• Other social facilities (drinking water supply) have been proposed in the Project budget?				• At this stage only Malir Expressway has been proposed.
Case No.	**Date**	**Venue**	**Occupation**	**Name**
2	15-11-2020	Magsi Goth	Labour	Jan Muhammad
			Labour	Abdul Wahid
			Labour	Sikandar
			Labour	Muhammad Murad
			Driver	Muhammad Saleem
			Driver	Sardar Ali
			Driver	Saimdas
			Shopkeeper	Abdul Majid
			Shopkeeper	Wali Muhammad
			Labour	Ali Baig
			Labour	Muhammad Mushtaq
			Labour	Riaz Ahmed
			Labour	Jamal Khan
			Govt. Servant	Jamal Khan
			Labour	Abdul Razaq
			Labour	Zulfiqar Ali
			Labour	Muhammad Ayub
			Private Service	Amir Ali
Question Raised the Participants				**Response of the Consultant**
• Residential area falls in the ROW of the proposed road and residents of the Magsi Goth will be displaced. Will all DPs will be resettled. • Is it possible to change the alignment in order to avoid the adverse impacts on residential area? • What is the purpose of the public consultations and social survey?				• The compensation of all affected structures will be provided with all allowances and shifting allowances as per resettlement policies. • Impacts will be discussed with the design team to minimize the impacts on residential area and to avoid human disturbance. • The concerns of the local people will be addressed and design of the road will be improved with valuable suggestions.
Sr. No.	**Date**	**Venue**	**Occupation**	**Name**

Sr. No.	Date	Venue	Occupation	Name
3	15-11-2020	Sammo Goth	Labour	Muhammad Yaseen
			Labour	Muhammad Ameen
			Labour	Mushtaq Ahmed
			Labour	Muhammad Afzal
			Labour	Muhamad Akhtar
			Labour	Muhammd Sqlain
			Labour	Muhammad Saqlain
			Labour	Muhammad Imran
			Labour	Muhammad Imran
			Labour	Muhammad Sadam
			Driver	Muhammad Aslam
			Private Service	Shahzaib
			Labour	Abdul Rauf
			Labour	Muhammad Ibrahim
			Labour	Rajab Ali

Question Raised by the Participants	Response of the Consultant
• From where the route of the road has been proposed and from where of the area it is passing? • Residential area of the Sammo Goth is under impact and housing and religious structures will be affected will Displaced persons will be resettled? • Is there possibility to change the alignment to minimize the adverse impacts on the residential areas. • When will construction of the road start? • Private land will be under the impact and owners will be compensated?	• The route of the proposed road was briefed with the help of design map and showing GPS location in detail. • The compensation of all affected structures will be provided with all allowances and shifting allowances as per resettlement policies. • Alignment of the proposed route has been designed to minimizing the human disturbance. Moreover, the impacts. • After completion of all studies and final approval the construction of the road will start. • All affected persons of the land will be compensated against loss of their assets and land.

Sr. No.	Date	Venue	Occupation	Name
4	14-11-2020	RD-13+000	Farmer	Muhammad Sharif
			Farmer	Saleh Muhammad
			Farmer	Muhammad Imran
		RD-16+000	Private Service	Shakeel Ahmed
			Labour	Mirza Usman Ali
			Labour	Abdul Ghafar
		RD-18+000	Private Service	Abdul Sattar
			Imam Mosque	Abdul Razaq

Sr. No.	Date	Venue	Occupation	Name
			Labour	Khan Muhammad
			Labour	Wali Muhammadd
		RD-23+000	Labour	Hussain Balhsh
			Farmer	Bachal
			Famer	Ali Akbar
			Farmer	Irfan Ahmed
		RD-35+000	Business	Ali Badr ul Din
			Shopkeeper	Muhammad Ramzan
			Business	Haji Mashooq Ali Magsi

Question Raised by the Participants	Response of the Consultant
• What about the compensation of residential structures who have built at the government land? • How compensation for the land to be acquired will be paid and who will pay compensation?	• Compensation will be given to all DPs including the encroachers against their loss of structures and assets. • Land evaluation will be completed by Revenue Department after the demarcation of RoW of the proposed road and compensation package will be prepared for all land affected APs in the document of LARP as per ADB policy and National & Provincial Laws. For land compensation land amount will be transferred to Revenue Departments of districts.
• From where the labour force will be hired during the construction period. • Are there other civic facilities with the Project? Water filtration plant should be provided. • Local people will face difficulties to move other area due to construction of road.	• The contractor will be bound through agreement to hire maximum unskilled labour from the local area to benefit the local communities. • Suggestions for the provision of water filtration plant for locals and improvement of civic facilities in Project Area have been recorded. • Crossing will be provided at different locations and only main roads will be connected with the Malir Expressway

Annex XII – Consultations with Females

GENDER CONSULTATIONS

SHAH FAISAL COLONY					
Sr. No.	**Date**	**Name**	**Age**	**Education**	**Occupation**
1.	18-11-2020	Ms. Nasmeen Zafar	35	Graduate	Housewife
2.		Ms. Fazilat Jahan	55	Matric	Housewife
3.		Ms. Sabeen Zehra	36	Intermediate	Housewife
4.		Ms. Rizwana Qasim	58	Graduate	Housewife
5.		Ms. Anila Mahrukh	40	Middle	Housewife
6.		Ms. Najma Begum	40	Illiterate	Housewife
7.		Ms. Shabeena	35	Middle	Housewife
8.		Ms. Razi Quasar	27	Illiterate	Housewife
9.		Ms. Nasreen	40	Illiterate	Housewife
10.		Ms. Sarwat	35	Matric	Health Worker
11.		Ms. Nazish	19	Graduate	Student
SAMMO GOTH					
Sr. No.	**Date**	**Name**	**Age**	**Education**	**Occupation**
1.	18-11-2020	Ms. Asiay Khamiso	50	Illiterate	Housewife
2.		Ms. Shadia Zakar	30	Illiterate	Housewife
3.		Ms.Zahida G Mustafa	20	Illiterate	Housewife
4.		Ms. Najma Murtaza	25	Illiterate	Housewife
5.		Ms. Khalida Abdullah	25	Illiterate	Housewife
6.		Ms. Hamada Ali	22	Illiterate	Housewife
7.		Ms. Noor Jhan	19	Illiterate	Housewife
8.		Ms. Huma Rajab	28	Illiterate	Housewife
9.		Ms. Ramzan M Ali	24	Illiterate	Housewife
10.		Ms. Aysha Wali Moh	70	Illiterate	Housewife
11.		Ms. Hayaat Khatoon	35	Illiterate	Housewife
12.		Ms. Robina Latif	25	Illiterate	Housewife
13.		Ms. Najma Faisl	23	Illiterate	Housewife
14.		Ms. Jamila Khan Mohd	28	Illiterate	Housewife
15.		Ms. Yasmeen Taj Mohd	30	Illiterate	Housewife

Annex XIII – Guide Traffic Management Plan

GUIDELINE TRAFFIC MANAGEMENT PLAN

1. Need for Plan

During the construction period of the project, considerable vehicular movement carrying large amounts of material and machinery is expected. This will definitely interrupt the local traffic and is therefore important to manage the traffic to avoid the nuisance to local residents in terms of noise, dust, congestion and inconvenience.

2. The plan

The objective of Traffic Management Plan (TMP) is to define the requirements that should be implemented to mitigate any potential negative risks to the environment, workers or the community resulting from construction traffic.

The TMP will advise and inform site Contractors and external suppliers of equipment and materials of access and entry points along with other key information such tipping areas and wash-out areas. It is intended to compliment and work alongside relevant EMP. The TMP will be classed as “live” and therefore be subjected to updates as required.

The Contractor, at the time of the execution of the project, will prepare a comprehensive TMP in coordination with local traffic police department, WSD, emergency services and local administrative department. WSD and CSC will review and approve the Contractor’s TMP. The Contractor’s TMP shall include following mitigation measures during its preparation:

- Undertake a road conditions assessment prior to and following the peak construction period, to assess any damage to road infrastructure that can be attributed to Project development.
- Repair damage as appropriate or enter into a voluntary agreement with the relevant roads authority to reimburse the cost of any repairs required to the public road network as a result of the Project.
- Spoil dumpsites located close to project site to minimize journey distance and limit movements to site access roads.
- Construction of worker accommodation on site to reduce light vehicle movements relating to travel to/ from the site.
- Provision of bus/minibus services for personnel living in nearby settlements.
- Movements of construction workers will be planned to avoid the busiest roads and times of day when traffic is at its greatest.
- Schedule deliveries and road movements to avoid peak periods.
- Driver training for HGV drivers and refresher course every six months for project drivers.
- Speed restrictions for project traffic travelling through communities (to be agreed with National Highway Authority).
- Run a safety campaign to improve the people’s knowledge of the traffic hazard on their roads, public information and other activities to address the issues.

- Run a pedestrian awareness programme.
- Temporary signage

The traffic management plan for the project corridor is provided below.

3. Other Recommendations

It is important to manage public access routes during construction because it can cause delay to local traffic and create a safety hazard both on and offsite. People working and living near the tower sites would be annoyed by the emissions, noise and visual intrusion of queuing vehicles. Some important factors involved in access routes and site traffic are as follows:

3.1. Public Access Routes

The use of public road for site access may be restricted in terms of:

- Vehicle size, width and type of load
- Time limits
- Parking
- Pedestrian conflicts

Contractor should have consultation with the local police or local authority to address these issues and to effectively manage them before the beginning of the construction.

3.2. Site Workers Traffic

Site personnel should not be permitted to park vehicles right on the road; this will lead to disruption in material deliveries. Designated parking areas with appropriate parking space will be needed for this purpose; any plain area near construction site can be used for this purpose.

3.3. Site Rules

- Access to and from the site must be only via the specified entrance.
- On leaving the site, vehicles must be directed to follow the directions given.
- Drivers must adhere to the site speed limits.
- All material deliveries to site must keep allocated time limits.
- No material or rubbish should be left in the loading-unloading area.
- Develop a map for alternate routes showing material delivery services.
- Assign designated personnel on site to receive deliveries and to direct the vehicles.
- Monitor vehicle movement to reduce the likelihood of queuing or causing congestion in and around the area.
- Project vehicles should have a unanimous badge or logo on windscreen displaying that they belong to the project.

4. Contractor's Obligation

The traffic management plan of the Contractor should be safe enough and widening of any access roads and construction of the detours (as applicable and practical) must be completed

prior to start of project construction activities so that heavy vehicular transportation for construction activities do not hinder the normal course of traffic lanes. Contractor must ensure that road closures are carried out by a competent person. The Contractor obligation must include the display of traffic signs according to the need to divert the traffic volume and to guide the road users in advance. The traffic sign, traffic light should be placed from any diverting route or road marking.

The Contractor should consider the environmental and social impacts of the traffic during construction. It will be sole responsibility of the Contractor to implement a plan which produces minimum nuisance to the local people and to the environment. Safety of the people should be given due importance. It will be under Contractor obligation to notify the traffic management plan and its later changes to CSC, WSD, emergency services and Traffic Police, and also publish weekly programme in the local newspaper.

Annex XIV – Guide Occupational Health & Safety Plan

GUIDELINE OCCUPATIONAL HEALTH AND SAFETY PLAN

Occupational Health and Safety covers all personnel working under the project and will be in line with the World Bank EHS guidelines on health and safety.

The Occupational Health and Safety program will aim to ensure that the workplace is safe and healthy by: addressing the hazards and risks at the workplace; outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the workplace or workplaces; and, specifying how consultation, training and information are to be provided to employees at various workplaces.

Some of the risks/hazards associated with workplaces are due to working close to or at sites associated with the various project construction activities. Other risks associated with the project construction phase include risk of increase of vector borne and other different diseases.

The following sections will be implemented during the construction phase to address and ensure workers' health and safety.

1.1 SCREENING AND REGULAR UNANNOUNCED CHECKING OF WORKERS

As per the procedure for hiring workers, all contractors and labor agencies are required to make all prospective workers undergo medical tests to screen for diseases and sicknesses, prior to selection and employment of any worker. The contractor is also responsible for ensuring that no worker who has a criminal record is employed at the project site. It will be ensured that all workers undergo medical tests to screen diseases at source and at sites in consultation with the designated Health Officer.

In addition to this, the Project Management will also undertake sudden, unannounced checks on workers to look for diseases such as COVID-19, HIV, STDs, and hepatitis and take necessary steps as mandated by the Contractual agreement between the Contractor and the Worker(s).

1.2 MINIMIZING HAZARDS AND RISKS AT THE WORKPLACE

To ensure safety at all work sites, the following will be carried out:

i. Installation of signboards and symbols in risky and hazardous areas, to inform workers to be careful.
ii. Construction of barricades around construction sites and deep excavated pits, to cordon off and deter entry of unauthorized personnel and workers into these areas.
iii. Providing a safe storage site/area for large equipment such as power tools and chains, to prevent misuse and loss.
iv. Proper Housekeeping: Ensuring that materials are all stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse. Brick stacks will not be more than 7 feet in height and for concrete blocks they will not be more than 6 feet high.
v. Removing all scrap timber, waste material and rubbish from the immediate work area as the work progresses.
vi. Where scaffolds are required, ensuring that each scaffold or its components shall be capable of supporting its own weight and at least 4 times the maximum intended load applied or transmitted to it. The platform/scaffold plank shall be at least 15 inches wide and 1.5 inches thick. The rope should be capable of supporting at least 6 times the maximum intended load applied or transmitted to that rope. Pole scaffolds over 60 feet in height shall be designed by a registered professional engineer and shall be

constructed and loaded in accordance with that design. Where scaffolds are not provided, safety belts/safety nets shall be provided;

vii. Ensure that all ramps or walkways are at least 6 feet wide, having slip resistance threads and not inclined at more than a slope of 1 vertical and 3 horizontal.

viii. Stacking away all excavated earth at least 2 feet from the pit to avoid material such as loose rocks from falling back into the excavated area and injuring those working inside excavated sites.

ix. Constructing support systems, such as bracing to adjoining structures that may be endangered by excavation works nearby.

x. Only a trained electrician to construct, install and repair all electrical equipment to prevent risks of electrical shocks and electrocution.

xi. Install fire extinguishers and/or other fire-fighting equipment at every work site to prepare for any accidental fire hazards.

1.3 PROVISION OF PERSONAL PROTECTIVE EQUIPMENT

Risks to the health and safety of workers can be prevented by provision of Personal Protective Equipment (PPEs) to all workers. This will be included in the construction cost for each Contractor. Depending on the nature of work and the risks involved, contractors must provide without any cost to the workers, the following protective equipment:

i. High visibility clothing for all personnel during road works must be mandatory.

ii. Helmet shall be provided to all workers, or visitors visiting the site, for protection of the head against impact or penetration of falling or flying objects.

iii. Safety belt shall be provided to workers working at heights (more than 20 ft) such as roofing, painting, and plastering.

iv. Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects on feet.

v. Ear protecting devices shall be provided to all workers and will be used during the occurrence of extensive noise.

vi. Eye and face protection equipment shall be provided to all welders to protect against sparks.

vii. Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxic gas/vapor.

viii. Safety nets shall be provided when workplaces are more than 25 feet (7.5 m) above the ground or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors or safety belts is impractical.

The specific PPE requirements for each type of work are summarized below.

Table 1: PPE Requirement List

Type of Work	PPE
Elevated work	Safety helmet, safety belt (height greater than 20 ft), footwear for elevated work.
Handling work safety	Helmet, leather safety shoes, work gloves.
Welding and cutting work	Eye protectors, shield and helmet, protective gloves.
Grinding work	Dust respirator, earplugs, eye protectors.
Work involving handling of chemical substances	Dust respirator, gas mask, chemical-proof gloves. Chemical proof clothing, air-lined mask, eye protectors.
Wood working	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Blasting	Hard hat, eye and hearing protection.
Concrete and masonry work	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Excavation, heavy equipment, motor graders, and bulldozer operation	Hard hat, safety boots, gloves, hearing protection.
Quarries	Hard hat, eye protectors, hearing protection, safety footwear, leather

Type of Work	PPE
	gloves and dust respirator.

1.4 PROCEDURES TO DEAL WITH EMERGENCIES SUCH AS ACCIDENTS, SUDDEN ILLNESS AND DEATH OF WORKERS

First aid kits will be made available at all times throughout the entire construction period by the respective contractors. This is very important, because most work sites will be at some distance from the nearest hospital. In addition to the first aid kits, the following measures should be in place:

i. Provision of dispensaries by the individual EPC contractor.
ii. A vehicle shall be on standby from the Project Office so that emergency transportation can be arranged to take severely injured/sick workers to the nearest hospital for immediate medical attention.
iii. A designated Health Officer/worker for the Project will be identified as a focal person to attend to all health and safety related issues. This employee's contact number will be posted at all work sites for speedy delivery of emergency services. The focal person shall be well versed with the medical system and facilities available at the hospital.
iv. Communication arrangements, such a provision of radios or mobile communication for all work sites, for efficient handling of emergencies, will be made.

1.5 RECORD MAINTENANCE AND REMEDIAL ACTION

The Project Management will maintain a record of all accidents and injuries that occur at the work site. This work will be delegated by the contractor to the site supervisor and regularly reviewed every quarter by project management. Reports prepared by the contractor shall include information on the place, date and time of the incident, name of persons involved, cause of incident, witnesses present and their statements. Based on such reports, the management can jointly identify any unsafe conditions, acts or procedures and recommend for the contractor to undertake certain mitigative actions to change any unsafe or harmful conditions.

1.6 COMPENSATION FOR INJURIES AND DEATH

Any casualty or injury resulting from occupational activities should be compensated as per the local labor laws of Pakistan. Where compensation is sought by the injured party, proper procedures for documentation of the case will be followed, including a detailed report on the accident, written reports from witnesses, report of the examining doctor and his/her recommendation for treatment. Each individual contractor will be responsible for ensuring compensation for the respective workers.

1.7 AWARENESS PROGRAMS

The Project management will undertake awareness programs through posters, talks, and meetings with the contractors to undertake the following activities:

i. Dissemination sessions will clarify the rights and responsibilities of the workers regarding interactions with local people (including communicable disease risks, such as HIV/AIDS, COVID-19), work site health and safety, waste management (waste separation, recycling, and composting), and the illegality of poaching.
ii. Make workers aware of procedures to be followed in case of emergencies such as informing the focal health person who in turn will arrange the necessary emergency transportation or treatment.

1.8 NOMINATION OF A HEALTH AND SAFETY FOCAL PERSON

Within each site (especially if different sites are being implemented by different contractors), a Health and Safety Focal Person will be appointed. The Terms of Reference for the focal person will mainly be as follows:

i. Function as the focal person/representative for all health and safety matters at the workplace;
ii. Responsible for maintaining records of all accidents and all health and safety issues at each site, the number of accidents and its cause, actions taken and remedial measures undertaken in case of safety issues;
iii. Be the link between the contractor and all workers and submit grievances of the workers to the contractor and instructions/directives on proper health care and safety from the contractors back to the workers;
iv. Ensure that all workers are adequately informed on the requirement to use Personal Protective Equipment and its correct use;
v. Also responsible for the first aid kit and making sure that the basic immediate medicines are readily available.

1.9 SUGGESTED CONTENTS OF OCCUPATIONAL HEALTH AND SAFETY PLAN

The suggested contents of Occupational Health and Safety Plan to be developed by the Contractor(s) are described below:

a Purpose
b Scope of Application
c Complying Basis
d Occupational Health and Safety Objectives
e Organization and Responsibility
  - Contractor's Project Manager
  - HSE Management Department of the Contractor(s)
  - Medical Treatment Room of the Contractor(s)
  - Subcontractor's Project Manager
  - Subcontractor's HSE Managers
  - Occupational Health and Safety
  - Community Health and Safety
f Health Plan
  - Labour Protection
  - Sanitary Epidemic Prevention
g Safety Plan
  - Summary
  - Qualification Review
  - Safety Training
  - Construction Plans and Documents
  - Control Measures
  - Monitoring Measures
  - Management of the Key Safety Accidents
h Public Security Plan
i Local Community Health and Safety

Annex XV – Tree Counts & Plantation Plan

Section Number	RD (m)			Number of Trees
	To	From	Distirct	
1	00+000	00+250	Korangi	5
2	00+250	00+500	Korangi	0
3	00+500	00+750	Korangi	0
4	00+750	01+000	Korangi	0
5	01+000	01+250	Korangi	8
6	01+250	01+500	Korangi	3
7	01+500	01+750	Korangi	4
8	01+750	02+000	Korangi	0
9	02+000	02+250	Korangi	0
10	02+250	02+500	Korangi	9
11	02+500	02+750	Korangi	3
12	02+750	03+000	Korangi	2
13	03+000	03+250	Korangi	2
14	03+250	03+500	Korangi	0
15	03+500	03+750	Korangi	0
16	03+750	04+000	Korangi	0
17	04+000	04+250	Korangi	12
18	04+250	04+500	Korangi	0
19	04+500	04+750	Korangi	12
20	04+750	05+000	Korangi	6
21	05+000	05+250	Korangi	11
22	05+250	05+500	Korangi	12
23	05+500	05+750	Korangi	10
24	05+750	06+000	Korangi	40
25	06+000	06+250	Korangi	9
26	06+250	06+500	Korangi	21
27	06+500	06+750	Korangi	10
28	06+750	07+000	Korangi	17
29	07+000	07+250	Korangi	16
30	07+250	07+500	Korangi	24
31	07+500	07+750	Korangi	11
32	07+750	08+000	Korangi	8
33	08+000	08+250	Korangi	2
34	08+250	08+500	Korangi	19
35	08+500	08+750	Korangi	0
36	08+750	09+000	Korangi	2
37	09+000	09+250	Korangi	8
38	09+250	09+500	Korangi	8
39	09+500	09+750	Korangi	8
40	09+750	10+000	Korangi	9
41	10+000	10+250	Korangi	23
42	10+250	10+500	Korangi	16
43	10+500	10+750	Korangi	9
44	10+750	11+000	Korangi	8
45	11+000	11+250	Korangi	16
46	11+250	11+500	Korangi	13
47	11+500	11+750	Korangi	39
48	11+750	12+000	Korangi	10

Section Number	RD (m)			Number of Trees
	To	From	Distirct	
49	12+000	12+250	Korangi	28
50	12+250	12+500	Korangi	16
51	12+500	12+750	Korangi	37
52	12+750	13+000	Korangi	35
53	13+000	13+250	Korangi	45
54	13+250	13+500	Korangi	39
55	13+500	13+750	Korangi	8
56	13+750	14+000	Korangi	8
57	14+000	14+250	Korangi	39
58	14+250	14+500	Korangi	6
59	14+500	14+750	Korangi	27
60	14+750	15+000	Korangi	46
61	15+000	15+250	Korangi	38
62	15+250	15+500	Korangi	0
			Malir	27
63	15+500	15+750	Malir	26
64	15+750	16+000	Malir	27
65	16+000	16+250	Malir	25
66	16+250	16+500	Malir	29
67	16+500	16+750	Malir	45
68	16+750	17+000	Malir	34
69	17+000	17+250	Malir	27
70	17+250	17+500	Malir	18
71	17+500	17+750	Malir	25
72	17+750	18+000	Malir	14
73	18+000	18+250	Malir	27
74	18+250	18+500	Malir	8
75	18+500	18+750	Malir	24
76	18+750	19+000	Malir	23
77	19+000	19+250	Malir	9
78	19+250	19+500	Malir	49
79	19+500	19+750	Malir	53
80	19+750	20+000	Malir	29
81	20+000	20+250	Malir	18
82	20+250	20+500	Malir	9
83	20+500	20+750	Malir	9
84	20+750	21+000	Malir	2
85	21+000	21+250	Malir	0
86	21+250	21+500	Malir	3
87	21+500	21+750	Malir	13
88	21+750	22+000	Malir	2
89	22+000	22+250	Malir	1
90	22+250	22+500	Malir	8
91	22+500	22+750	Malir	10
92	22+750	23+000	Malir	6
93	23+000	23+250	Malir	3
94	23+250	23+500	Malir	4
95	23+500	23+750	Malir	14

Section Number	RD (m)			Number of Trees
	To	From	Distirct	
96	23+750	24+000	Malir	6
97	24+000	24+250	Malir	3
98	24+250	24+500	Malir	2
99	24+500	24+750	Malir	5
100	24+750	25+000	Malir	0
101	25+000	25+250	Malir	13
102	25+250	25+500	Malir	25
103	25+500	25+750	Malir	16
104	25+750	26+000	Malir	12
105	26+000	26+250	Malir	16
106	26+250	26+500	Malir	10
107	26+500	26+750	Malir	8
108	26+750	27+000	Malir	5
109	27+000	27+250	Malir	8
110	27+250	27+500	Malir	3
111	27+500	27+750	Malir	3
112	27+750	28+000	Malir	2
113	28+000	28+250	Malir	23
114	28+250	28+500	Malir	2
115	28+500	28+750	Malir	2
116	28+750	29+000	Malir	9
117	29+000	29+250	Malir	6
118	29+250	29+500	Malir	8
119	29+500	29+750	Malir	8
120	29+750	30+000	Malir	5
121	30+000	30+250	Malir	4
122	30+250	30+500	Malir	16
123	30+500	30+750	Malir	11
124	30+750	31+000	Malir	14
125	31+000	31+250	Malir	3
126	31+250	31+500	Malir	2
127	31+500	31+750	Malir	25
128	31+750	32+000	Malir	6
129	32+000	32+250	Malir	5
130	32+250	32+500	Malir	0
131	32+500	32+750	Malir	16
132	32+750	33+000	Malir	0
133	33+000	33+250	Malir	9
134	33+250	33+500	Malir	12
135	33+500	33+750	Malir	2
136	33+750	34+000	Malir	2
137	34+000	34+250	Malir	0
138	34+250	34+500	Malir	0
139	34+500	34+750	Malir	3
140	34+750	35+000	Malir	2
141	35+000	35+250	Malir	0
142	35+250	35+500	Malir	0
143	35+500	35+750	Malir	6

Section Number	RD (m)			Number of Trees
	To	From	Distirct	
144	35+750	36+000	Malir	6
145	36+000	36+250	Malir	3
146	36+250	36+500	Malir	3
147	36+500	36+750	Malir	0
148	36+750	37+000	Malir	4
149	37+000	37+250	Malir	16
150	37+250	37+500	Malir	4
151	37+500	37+750	Malir	4
152	37+750	38+000	Malir	2
153	38+000	38+250	Malir	7
154	38+250	38+500	Malir	2
155	38+500	38+736	Malir	4
Total Area of Each Landuse Class				**1831**

PLANTATION PLAN FOR MEP

Two rows of plants will be raised along the Malir Expressway, one on either side of the road. Distance from the outer boundary of the ROW and between two plants will be kept as 4 meters. Thus in one kilometer, 250 number of plants are to be raised. Total number of plants, along, 39-kilometer-long road, on both sides will be 9,750 x2= 19,500 Number. Thus a total of 19500 trees shall be planted in lieu of expected 1831 effected plants, which is more than 10 times of the effected plants.

Trees Recommended

Following trees are recommended for plantation, along this portion of the GT road on both sides.

Sr. No.	**Local Name**	***Scientific Name***
1.	Neem	*Azadirachata indica*
2.	Jungle jalebi	*Pithecellobium dulce*
3.	Sirris	*Acacia lebbek*
4.	Jacarnda	*Jacaranda moniosifolia*
7.	Silver Oak	*Grevillea robusta*
8.	*Pilkhan (white Fig)*	*Ficus virens*
9.	Jaman	*Eugenia jambolina*
10.	Kachnar	*Bauhinia variegate*

Plantation Cost

Break-up of Expenditure per Avenue kilometer @ Rs. 1500/- per diem: Break-up of Expenditure per Avenue kilometer or 250 plants @ Rs. 1500/- per diem:

FIRST YEAR

Sr. No.	**Item**	**Quantity**	**Rate**	**Amount (Rs.)**
1.	Layout	1 Av.km	2 MD/Av.km	3000.00
2.	Digging of Pits 2.5 ft. each 2.5x250 = 625 cft.	625 cft.	5 MD/Av.km	7500.00
3.	Cost of Plants including	250 No.	Rs100/- plant	25,000.00
4.	Cost of planting of plants	250 No.	Rs. 25/- plant	6250.00
5.	Carriage of plants from private nursery to site including loading/unloading	250 No.	Rs. 10/- plant	2500.00
6.	Cost of Manure and Bhall (silt) including carriage	1 Av. Km		20,000.00

7.	H/watering 50 times 250x50 with water bowser, one driver and one coolie	12500 no.	5MD/per %0	100,000.00
8.	Weeding twice 250x2	500 no.	2 MD/per %	15,000.00
9.	Reopening of Pits twice (250x2)/cft/pit	500 cft.	2 MD/per %	15,000.00
10.	Unforeseen			5750.00
Total				**200,000.00**

SECOND YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	Cost of Plants 20% Restocking	50 No.	Rs.100/- plant	5,000.00
2.	Cost of planting	50 No.	Rs. 25/- plant	1250.00
3.	Carriage of plants	50 No.	Rs. 10/- plant	500.00
4.	H/watering 50 times with water bowser, one driver and one coolie	12500 no.	5MD/per %0	100,000.00
5.	Reopening of Pits twice (250x2)	500 cft.	2 MD/per %	1,5000.00
6.	Weeding twice 250x2	500 no.	2 MD/per %	1,5000.00
7.	Unforeseen			1250.00
Total				**138,000.00**

THIRD YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	Cost of Plants 10% Restocking 25 No.	25 No.	Rs.100/- plant	2500.00
2.	Cost of planting	25 No.	Rs. 25/- plant	625.00
3.	Carriage of plants	25 No.	Rs. 10/- plant	250.00
4.	H/watering 40 times x250 no.	10,000 no.	5MD/per %0	75000.00
5.	Reopening of Pits twice (250x2)	500	5MD/per %0	3750.00
6.	Unforeseen			2875.00
Total				**85,000.00**

FOURTH YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)

1.	H/watering 30 times	7500 no.	5MD/per %0	56250.00
5.	Pruning and cleaning of plants	250 no.	5MD/per %0	1875.00
6.	Unforeseen			1875.00
Total				**60,000.00**

Cost for raising 1 Av. Km and Maintenance or 250 plants: = Rs.4,83,000/-
For 4 years

Total cost for 19500 plants and their maintenance for 4 years = Rs. 37,674,000/-

Total Cost = 37.68 Million

Annex XVI – Chance Find Procedure

ARCHAEOLOGICAL 'CHANCE FIND' PROCEDURE

1. BACKGROUND

The purpose of this document is to address the possibility of archaeological deposits becoming exposed during ground altering activities within the project area and to provide protocols to follow in the case of a chance archaeological find to ensure that archaeological sites are documented and protected as required.

The Antiquities Act, 1975, protects archaeological sites, whether on Provincial Government owned or private land. They are non-renewable, very susceptible to disturbance and are finite in number. Archaeological sites are an important resource that is protected for their historical, cultural, scientific and educational value to the general public and local communities. Impacts to archaeological sites must be avoided or managed by development proponents. The objectives of this 'Archaeological Chance Find Procedure' are to promote preservation of archaeological data while minimizing disruption of construction scheduling It is recommended that due to the moderate to high archaeological potential of some areas within the project area, all on site personnel and contractors be informed of the Archaeological Chance Find Procedure and have access to a copy while on site.

2. POTENTIAL IMPACTS TO ARCHAEOLOGICAL SITES

Developments that involve excavation, movement, or disturbance of soils have the potential to impact archaeological materials, if present. Activities such as road construction, land clearing, and excavation are all examples of activities that may adversely affect archaeological deposits.

3. RELEVANT LEGISLATION

It ensures the protection, preservation, development and maintenance of antiquities in the provinces of Pakistan. The Act defines "antiquities" as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the relevant provincial governments to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, any archaeological discovery made during the course of the project.

4. REMEDIES AND PENALTIES

The Antiquities Act, 1975 provides for heritage inspection or investigation orders, temporary protection orders, civil remedies and penalties to limit contraventions. These powers provide:

''A contravention of any provision of this Act or the rules shall, where no punishment has been specifically provided be punishable with rigorous imprisonment for a term which may extend to two years, or with fine up to rupees ten hundred thousand, or with both. ''

5. ARCHAEOLOGICAL 'CHANCE FIND' PROCEDURE

If you believe that you may have encountered any archaeological materials, stop work in the area and follow the procedure below:

The following 'chance-find' principles will be implemented by the contractor throughout the construction works to account for any undiscovered items identified during construction works:

i. Workers will be trained in the location of heritage zones within the construction area and in the identification of potential items of heritage significance.
ii. Should any potential items be located, the site supervisor will be immediately contacted and work will be temporarily stopped in that area.

iii. If the site supervisor determines that the item is of potential significance, an officer from the Department of Archaeology (DoA) will be invited to inspect the site and work will be stopped until DoA has responded to this invitation.

iv. Work will not re-commence in this location until agreement has been reached between DoA and MEX as to any required mitigation measures, which may include excavation and recovery of the item.

v. A precautionary approach will be adopted in the application of these procedures.

6. DETAILED PROCEDURAL STEPS

- If the Director, department of Archaeology receives any information or otherwise has the knowledge of the discovery or existence of an antiquity of which there is no owner, he shall, after satisfying himself as to the correctness of the information or knowledge, take such steps with the approval of the Government, as he may consider necessary for the custody, preservation and protection of the antiquity.
- Whoever discovers, or finds accidentally, any movable antiquity shall inform forth with the Directorate within seven days of its being discovered or found.
- If, within seven days of his being informed, the Director decides to take over the antiquity for purposes of custody, preservation and protection, the person discovering or finding it shall hand it over to the Director or a person authorized by him in writing.
- Where the Director decides to take over an antiquity, he may pay to the person by whom it is handed over to him such cash reward as may be decided in consultation with the Advisory Committee.
- If any person, who discovers or finds any movable antiquity contravenes the provisions of the Act, he shall be punishable with imprisonment for a term which may extend to five (05) years, or with fine not less than fifteen hundred thousand rupees or with both and the Court convicting such person shall direct that the antiquity in respect of which such contravention has taken place shall stand forfeited to Government.
- The Director or any officer authorized by him with police assistance may, after giving reasonable notice, enter into, inspect and examine any premises, place or area which or the sub-soil of which he may have reason to believe to be, or to contain an antiquity and may cause any site, building, object or any antiquity or the remains of any antiquity in such premises, place or area to be photographed, copied or reproduced by any process suitable for the purpose.
- The owner or occupier of the premises, place or area shall afford all reasonable opportunity and assistance to the Director.
- No photograph, copy of reproduction taken or made shall be sold or offered for sale except by or with the consent of the owner of the object of which the photograph, copy or the reproduction has been taken or made.
- Where substantial damage is caused to any property as a result of the inspection, the Director shall pay to the owner thereof reasonable compensation for the damage in consultation with the Advisory Committee.
- If the Director after conducting an inquiry, has reasonable grounds to believe that any land contains any antiquity, he may approach the Government to direct the Revenue Department to acquire such land or any part thereof and the Revenue Department shall thereupon acquire such land or part under the Land Acquisition Act, 1894 (I of 1894), as for a public purpose.

Annex XVII – Emergency Preparedness & Response Plan

GUIDELINE EMERGENCY PREPAREDNESS AND RESPONSE PLAN

1.1 PURPOSE

The purpose of this Emergency Response Procedure is to provide measures and guidance for the establishment and implementation of emergency preparedness plans for the project. The aim of the Emergency Response Procedure is to:

i. Ensure all personnel and visitors to the office/job sites are given the maximum protection from unforeseen events.
ii. Ensure all personnel are aware of the importance of this procedure to protection of life and property.

1.2 EMERGENCY PREPARATION AND RESPONSE MEASURE SCOPE

The emergency management program is applied to all Project elements and intended for use throughout the Project life cycle. The following are some emergencies that may require coordinated response.

i. Construction Accident
ii. Road & Traffic Accident
iii. Hazardous material spills
iv. Structure collapse or failure
v. Trauma or serious illness
vi. Sabotage
vii. Fire
viii. Environmental Pollution
ix. Loss of person
x. Community Accident

1.3 RESPONSIBILITIES

The detailed roles and responsibilities of certain key members of the Emergency Response team available to assist in emergency are provided in **Table 1** below.

Table 1: Emergency Response Team

Action Group	Responsibility
Emergency Coordinator	▪ Overall control of personnel and resources. ▪ The Emergency Coordinator will support and advise the Site Safety Supervision as necessary. ▪ Serves as public relations spokes persons, or delegates to some staff member the responsibility for working with news media regarding any disaster or emergency. Also assure proper coordination of news release with appropriate corporate staff or other designated people.
Site Safety Supervision (Emergency Commander)	▪ Overall responsibility for activating emergency plan and for terminating emergency actions. ▪ Be alternative of emergency response chairpersons. ▪ Disseminates warnings and information as required to ensure all people in the immediate area have been warned and evacuated either by alarms or by word of mouth. ▪ Supervise the actions of the Emergency Response Team to ensure all persons are safe from the danger. ▪ Notify outside authorities if assistance is required. ▪ Carries the responsibility for coordinating actions including other organizations in accordance with the needs of the situation.

Action Group	Responsibility
	▪ Ensure maximum co-operation and assistance is provided to any outside groups called to respond to an emergency. ▪ Establish and appoint all emergency organization structure and team. ▪ Assures adequate delegation of responsibilities for all key positions of assistants on the Project to assist with any foreseeable emergency. ▪ Ensure resources available to purchase needed emergency response equipment and supplies. ▪ Assures that all persons on the Emergency Response Team aware and fully understand their individual responsibilities for implementing and supporting the emergency plan. ▪ Establish the emergency drill schedule of all identified emergency scenarios, track the status and evaluate the emergency. ▪ The Emergency Commander shall ensure that senior management personnel have been reported of the emergency as soon as practical after the event.
Security Team	▪ Ensure that the exit route is regularly tested and maintained in good working order. ▪ Maintain station at the security gate or most suitable location to secure the area during any emergency such that only authorized personnel and equipment may enter, prevent access to the site of unauthorized personnel. ▪ Assist with strong/activation of services during an emergency. ▪ Ensure vehicles and obstructions are moved to give incoming emergency vehicles access to the scene, if ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct any incoming emergency service to the site of emergency.
Rescue & Medical Team	▪ Protect the injured from further danger and weather. ▪ Provide treatment to the victim(s) to the best of their ability by first aid and then transfer to hospital. ▪ Remain familiar with the rescue activities and rescue apparatus. ▪ Assist outside medical services personnel when they arrive
General Administration Team	Response to support any requested general facilities for assisting Emergency Response Team in their work.
Government Relation Team	▪ Coordinate with local government on a matter of concerned in the emergency response plan to liaise with local officers in their affair for support Emergency Response Team. ▪ Coordinate emergency plan with the government authorities, local community.
Environment Team	In case of emergency related to the environmental pollution such as the chemical spill, oil spill into the ambient, the environment team will support the technical advice to control and mitigate the pollution until return to the normal situation.
Department Heads	▪ Call up of personnel into the safe location for protective life and property. ▪ Take immediate and appropriate action while Emergency Response Team is being mobilized. ▪ Keep in touch with the Emergency Commander ▪ Control and supervise operators and contractors on the implementation of this procedure, with consultation with Safety Team as necessary. ▪ Provide and maintain emergency equipment of their responsible areas.

Action Group	Responsibility
Other Staff and Employees	▪ All other staff and employees will remain at their workstations or assembly point unless directed otherwise from Emergency Response Team. ▪ Each supervisor will ensure that all members of his work group are accounted for and keep in touch with each of their Department Head.

1.4 PROCEDURE

Emergency situation and injuries to person can occur at any time or place either on Project site or elsewhere. The most two common types of emergencies on site are fire and serious accident.

Figure 3.1 Emergency Procedures for Fire

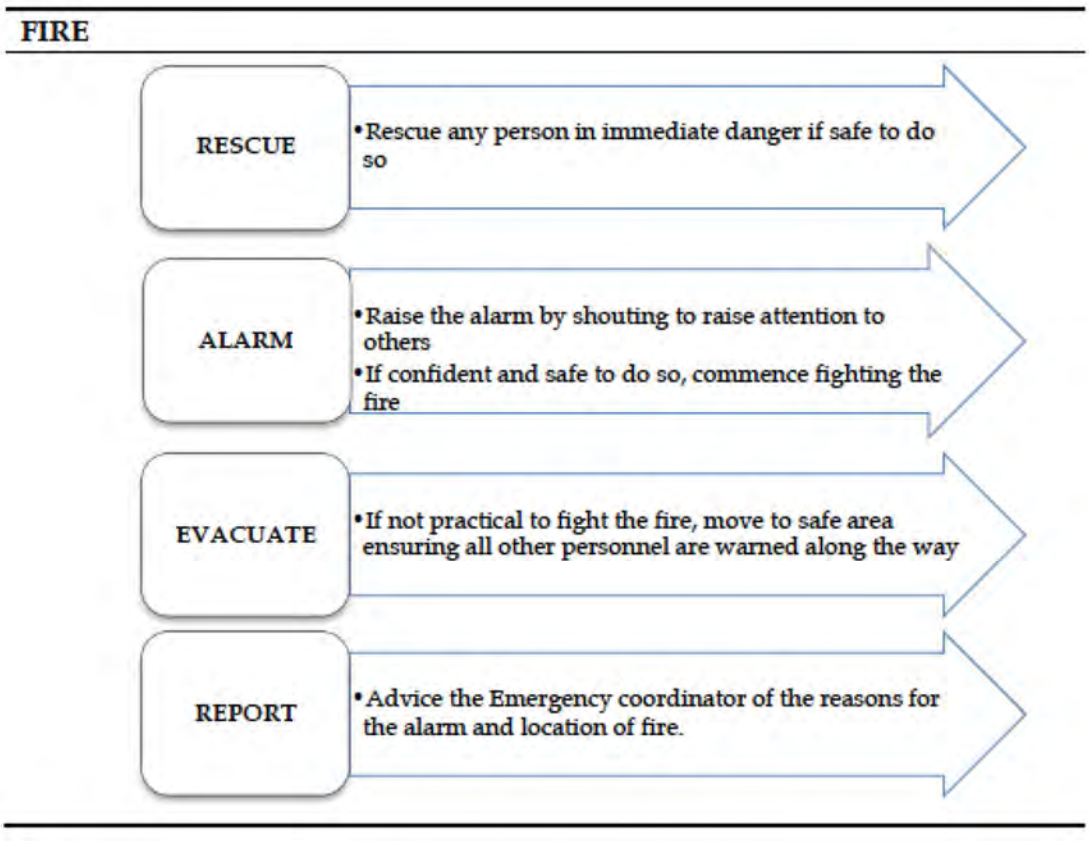
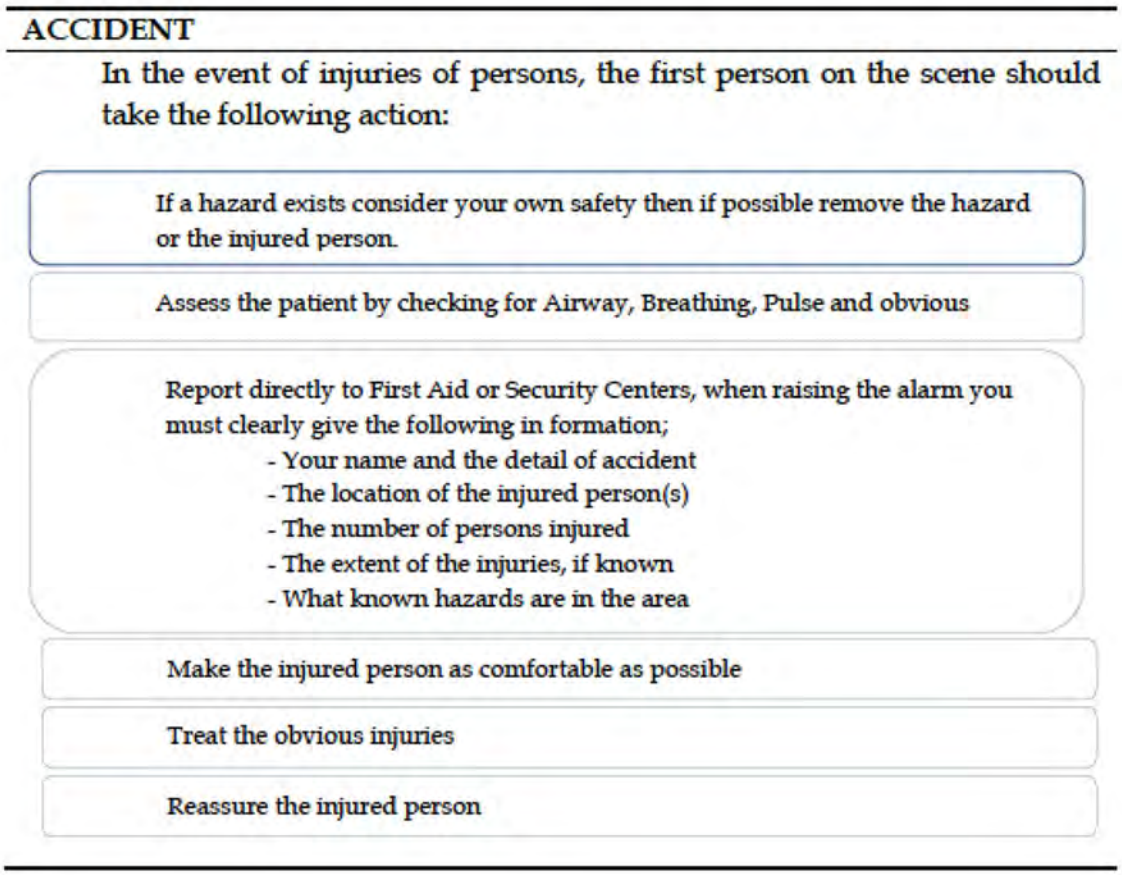


Figure 3.2 Emergency Procedures for Serious Accident



3.5 COMMUNICATION WITH AUTHORITIES / PRESS AT SITE

In the event of an accident or incident, only senior staff is permitted to give factual information to the authorities for resource of liability exposure. The press must be avoiding politely, at all costs, with the terse comment that “the matter is under investigation and relevant information when available will be provided by our Head Office” Do not ever give your opinion or story.

1.5 FIRST AID PERSONS

Upon advice of medical emergency, make immediate assessment to response required and if necessary, advise security to summon ambulance or medical assistance, the qualified first aid attendant should also,

- Provide treatment to the victim(s) to the best of his/her ability.
- Ensure the safety of victims by ceasing any work activity in the area.
- Protect the injured from further danger and weather.
- Assist medical services personnel when they arrive.

1.6 GENERAL ADMINISTRATION TEAM

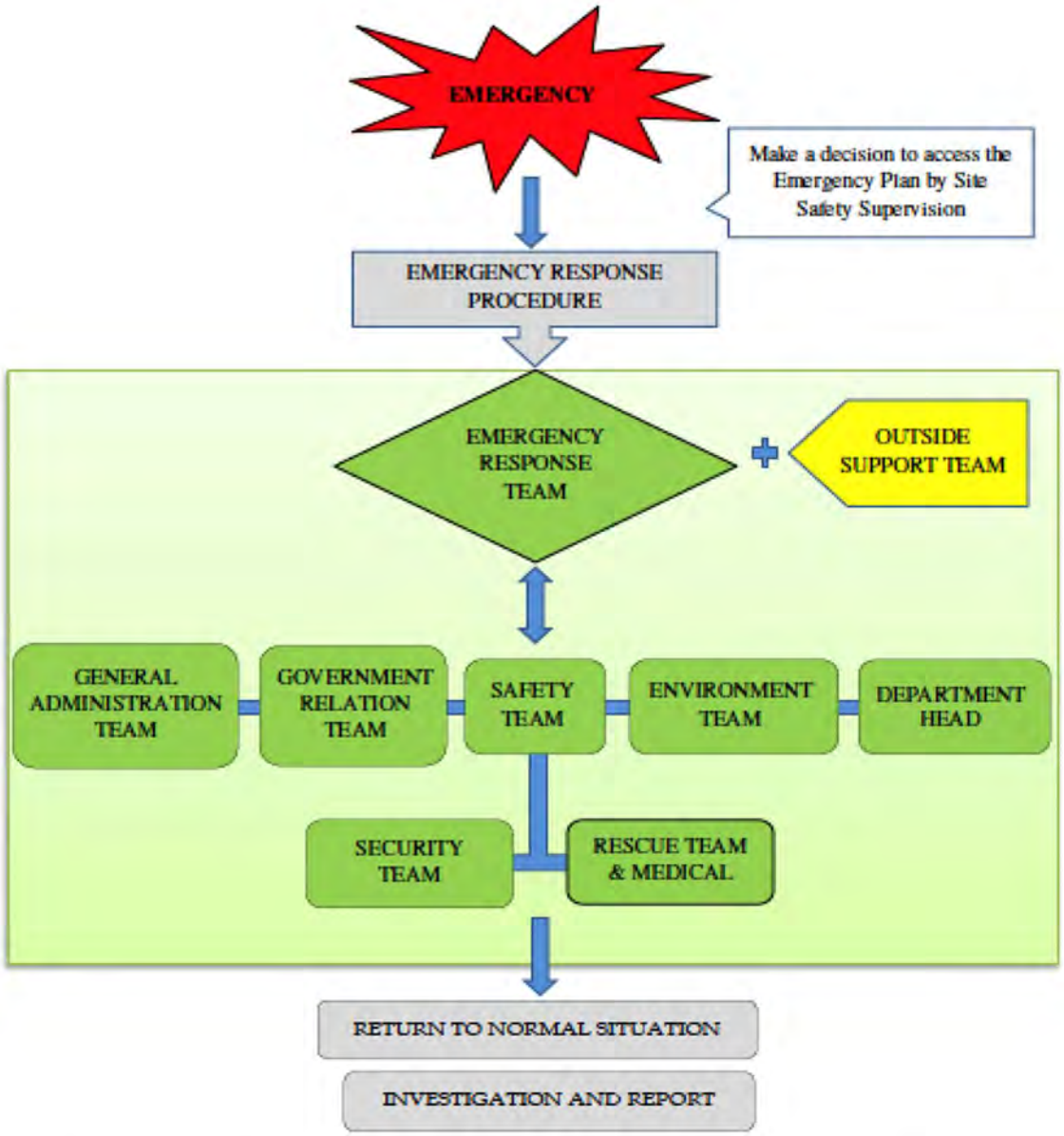
Upon advice of medical emergency, maintain contact with first aid personnel and summon ambulance if required.

1.7 SECURITY TEAM

- If ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct vehicle closest to the scene.
- Prevent access to the site of unauthorized personnel (press, etc.).

1.8 EMERGENCY COORDINATOR

- The Emergency Coordinator shall assist emergency personnel at the scene as required through allocation of company resources.
- The Emergency Coordinator shall ensure next-of-kin are properly notified as soon as possible and give whatever company support and assistance is necessary to assist them bundle the situation
- The Emergency Coordinator shall ensure that senior management personnel are advised of the emergency as soon as practical after the event.



Note: Name of contact person and call number from Owner/Contractor to be determined.

1.9 INCIDENT AND ACCIDENT REPORT

Section A: Identification Data

Report No:	Date of Reported:	Reporter:	Sign:
Job Title:		Company Name:	

Section B: Violence Rate

Accident Violence: ☐ 01-Death ☐ 02-Serious Injury ☐ 03-Lost Time Injury ☐ 04-First Aid ☐ 05- Not Injury ☐ 06-Near Miss

Property Damage Cost: ☐ 1-2,000 USD ☐ 2,001-10,000 USD ☐ 10,001-50,000 ☐ > 50,001

Section C: Environmental Impact

Affected area	☐ Construction area	☐ Public area	
Receptor	☐ None	☐ Workers	☐ Community
Type of pollution	☐ Physical	☐ Chemical	☐ Biological
Toxicity	☐ Non-toxic	☐ Low - toxic	☐ High - toxic
Return to Normal	☐ 1 day	☐ 1 day to 1 week	☐ ≥ 1 week
Cumulative impact	☐ Non-cumulative	☐ Cumulative	

Section D: Injured/Illness Employee

1.Name:	Sex:	Date of Birth: Month	Day	Year	Age:	Regular Job Title:	Experience: In this job title Years	Weeks	In this Project Years	Weeks
	☐ Male ☐ Female									

Site:	Company:	Reference:	Phone No:	Social Security Numbe

Part of Body Injured or Affected:

☐ Head ☐ Hands ☐ Face ☐ Nose
☐ Eyes ☐ Legs ☐ Teeth ☐ Neck
☐ Trunk ☐ Toes ☐ Elbow ☐ Shoulder
☐ Back ☐ Ankle ☐ Wrist ☐ Foot
☐ Arms ☐ Thump ☐ Fingers ☐ Internal

Remark: .....

Nature of Injury or Illness:

☐ Laceration ☐ Amputation ☐ Puncture ☐ Fracture
☐ Strain & Sprain ☐ Burns ☐ Contusion ☐ Dry Heat Friction
☐ Hernia ☐ Foreign Body ☐ Chemical ☐ Contamination
☐ Skin (Occupationnel) ☐ Rash ☐ Irritation

Remark: .....

2.Name:	Sex:	Date of Birth: Month	Day	Year	Age:	Regular Job Title:	Experience: In this job title Years	Weeks	In this Project Years	Weeks
	☐ Male ☐ Female									

Site:	Company:	Reference:	Phone No:	Social Security Numbe

Part of Body Injured or Affected:

☐ Head ☐ Hands ☐ Face ☐ Nose
☐ Eyes ☐ Legs ☐ Teeth ☐ Neck
☐ Trunk ☐ Toes ☐ Elbow ☐ Shoulder
☐ Back ☐ Ankle ☐ Wrist ☐ Foot
☐ Arms ☐ Thump ☐ Fingers ☐ Internal

Remark: .....

Nature of Injury or Illness:

☐ Laceration ☐ Amputation ☐ Puncture ☐ Fracture
☐ Strain & Sprain ☐ Burns ☐ Contusion ☐ Dry Heat Friction
☐ Hernia ☐ Foreign Body ☐ Contamination ☐ Chemical
☐ Skin (Occupationnel) ☐ Rash ☐ Irritation

Remark: .....

Section E: Accidents/incident Details

Date Accident/Incident Occurred:	Time Accident/Incident Occurred:	Exact Location of the Accident / Incident:

Details of the actual Job Being done at the time:

Details of Accident / Incident / What actually happened?

Section F: Accident Cause (Basic cause mark X / Contributing cause, if any mark O)

UNSAFE CONDITIONS		UNSAFE ACTS	
1	☐ Inadequately Guarded	1	☐ Operating Without Authority / Training
2	☐ Unguarded	2	☐ Operating at Unsafe Speed
3	☐ Defective Tools, Equipment, or Substance	3	☐ Marking SHE Device Inoperative
4	☐ Unsafe Design or Construction	4	☐ Using Unsafe Equipment or Equipment Unsafely
5	☐ Hazardous Arrangement	5	☐ Unsafe Loading, Placing, Mixing
6	☐ Unsafe Illumination	6	☐ Taking Unsafe Position
7	☐ Unsafe Ventilation	7	☐ Working on Moving or Dangerous Equipment
8	☐ Unsafe Clothing	8	☐ Distraction, Teasing, Horse Play
9	☐ Insufficient Instruction	9	☐ Failure to use Personal Protective Devices
10	☐ Lack of system of work	10	☐ Lack of effective instruction or supervision

Why was the unsafe act committed? _____ Why did the unsafe condition exist? _____

Section G: Guide to Corrective Action (Base on the cause checked above, I am taking the following corrective action)

UNSAFE ACT	UNSAFE CONDITION	If Supervisor can't handle, then recommend to
☐ Stop the Behaviour	☐ Remove	☐ Site Engineer, or
☐ Study the job	☐ Guard	☐ Site Manager, or
☐ Instruct (tell-show-try-check)	☐ Warn	☐ Project Manager, or
☐ Follow Up	☐ Supervisory Training	☐ Safety Committee
☐ Enforce		

Detail below any immediate remedial actions that have been taken:

Detail below any corrective and preventative actions that could be taken to prevent future re-occurrence:	Responsible	Completion Date

Section H: Witness Statement	
Witness Name	Interviewer Name

Section I: Reviewed & Recommend by			
Recommendation:			
Reviewed By:	Position:	Signature:	Date:

Remarks : If Accident or Incident happened with lost time injury and affected to the publicity must further report to Safety Department;
: First Aid Cases will not applicable to this form;
: The accident report shall submit to Safety Department within 3 days
: Attached the photograph or sketch the location of accident / incident;

1.10 SUGGESTED CONTENTS OF EPRP

The Contractor should prepare the EPRP based on the guidelines provided in the above sections. The suggested structure of the EPRP is listed below:

1. Purpose
2. Applicable Scope
3. Preparation Basis
4. Emergency Response System
   - 4.1 Generals
   - 4.2 Emergency Response System
   - 4.3 Responsibilities
5. Major Safety Risks
6. Precautionary Measures
   - 6.1 Training and Exercise
   - 6.2 Hazard Source Monitor
   - 6.3 Alert Action
   - 6.4 Management Measures
7. Control Measures
   - 7.1 Response
   - 7.2 Response Procedures
   - 7.3 Emergency Response
   - 7.4 Emergency Completion and Restoration
8. Emergency Response Report and Settlement
9. Supporting Measures
   - 9.1 Communication
   - 9.2 Emergency Team
   - 9.3 Funding for Emergency
   - 9.4 Provisions and Resources
10. Records

Annex XVIII – Quarry Management Plan

ANNEX-XII: Guideline Quarry Management Plan

1.0 Introduction

After the completion of construction phase of the proposed project, it is the responsibility of the contractor to restore the site that has been disturbed due to construction activities. Karachi Metropolitan Corporation (KMC) should ensure that the environmental value of the project area is maintained for future generations to appreciate.

2.0 General Quarry Planning and Progressive Rehabilitation

A well-considered quarry development plan prior to starting work, or when opening up new areas will greatly reduce the effort required to achieve appropriate leading practice environmental and safety outcomes for quarry rehabilitation and closure.

The selection of a site, sequencing of quarrying and rehabilitation and final land-use should all be carefully planned prior to commencement of work at a quarry or borrow pit.

2.1 Progressive Rehabilitation

Progressive rehabilitation refers to the rehabilitation of completed parts of a quarry while extractive operations continue in other parts of the quarry. As new quarry sections are opened, worked out areas should be progressively rehabilitated to avoid increasing the total disturbed area of a quarry. Overburden and topsoil can be stripped from areas being opened up and placed directly onto worked out areas which are being rehabilitated. This will avoid double handling of materials and prevent degradation of the topsoil.

Progressive rehabilitation helps to minimize the visual impact of a quarry, control dust and erosion. It also assists in fostering good landowner and community relations.

Recommended progressive rehabilitation practices are:

- Agree on the final land form and use of a site with the relevant landowner.
- Rehabilitate in accordance with the intended final use of the land.
- Plan and develop the quarry in stages towards terminal areas so that progressive rehabilitation works can commence as soon as possible).
- Once the final landform is established, re-vegetate areas to stabilize the landform and to give the vegetation maximum time to establish while the quarry is still in operation.

2.2 Re-vegetation

Establishing a self-sustaining cover of vegetation is the best way to stabilize disturbed sites in the long term. Re-vegetation also minimizes the visual impact of quarries. Generally, the vegetation type which existed before the disturbance, or a similar vegetation type will regenerate most successfully.

Prior to the commencement of a quarrying activity the type of re-vegetation should be agreed with the landowner, and should be consistent with the proposed final land-use.

Some indigenous plant species may not thrive in areas where soil conditions are substantially different after quarrying. If this is the case, and the objective is to re-establish vegetation, which fulfils the function of the original native vegetation, then some species from outside the quarry area, may have to be introduced. Care must be taken to avoid introducing a species, which could become an unacceptable fire hazard, invade surrounding areas of native vegetation or become agricultural weeds.

Where agriculture is the planned land-use then the species planted should be those commonly used for pasture or crops known to be successful on soils of similar texture, drainage status, pH and fertility. Suitable legumes should always be considered for their ability to improve soil fertility.

3.0 Rehabilitation of Borrow Pits

Borrow pits are areas either in a road reserve or adjacent land holdings that have been used to extract materials such as gravels and soils. They can vary considerably in size, depending on the quantity of material taken and the borrow pits' reserve body of remaining material. The variable size, shape and nature of borrow pits preclude very specific recommendations; however the following general conditions apply:

- Before extraction commences, licenses and permits should be checked and limits of disturbance and/or clearing must be clearly marked out on the site before any ground disturbing activity takes place; and
- At the completion of extraction, the former borrow pit must be made stable and safe. This usually requires the sides of the pit to be reshaped with gentle safe grades. All disturbed areas associated with borrow pits must be retopsoiled, seeded, fertilized and mulched (if appropriate) as part of the restoration plan. Main Roads has been discouraging the conversion of borrow pits to stock watering points.

Reinstatement of Borrow Pits

- Reinstatement will be completed prior to handover of the completed road section. This may include the following:
- Fill excavated site with overburden stockpiles and perimeter berms, and graded to the desired slope and drainage path;
- Spread topsoil on top of the overburden;
- Develop/construct suitable surface slopes, drainage ditches and conduits to prevent water from collecting at the sites;
- Establish a vegetation cover corresponding to at least 75%[1] of the cover present prior to excavation (supporting photographs) and maintain following the first rains after reinstatement;
- Minimize erosion by focusing vegetation cover on side slopes of the excavated area; and
- Any required seeding will make use of local plant varieties

[1] RAPID PROGRAM BORROW PIT MANAGEMENTGUIDELINES, USAID

All the above mentioned measures need to be followed by the Contractor before handing over the site (s) back to the owner.

Annex XIX – Covid Management Plan

PRECAUTIONARY ACTION AGAINST THE POTENTIAL RISK OF NOVEL CORONAVIRUS

INTRODUCTION

On February 11, 2020 the World Health Organization announced an official name for the disease that is causing the 2019 novel coronavirus outbreak, first identified in Wuhan China. The new name of this is coronavirus disease 2019, abbreviated as COVID-19. In COVID-19, 'CO' stands for 'corona,' 'VI' for 'virus,' and 'D' for disease. Formerly, this disease was referred to as "2019 novel coronavirus" or "2019-nCoV".

Coronaviruses are a large family of viruses. Some cause illness in people, and others, such as canine and feline coronaviruses, only infect animals. Rarely, animal coronaviruses that infect animals have emerged to infect people and can spread between people. This is suspected to have occurred for the virus that causes Coronavirus Disease 2019 (COVID-19). Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) are two other examples of coronaviruses that originated from animals and then spread to people.

The risk of exposure to COVID-19 is no different for employees of Employer, Engineer, Contractor, and suppliers than for the general population. Contractor, therefore, must consider the physical well-being and safety of all the persons entitled to be on the Site and follow reasonable guidelines and recommendations of Government authorities and healthcare professionals. As experience has shown in other countries, confirmed cases of COVID-19 expand exponentially if health and safety controls are left unheeded.

Contractor should enforce all health and safety procedures at Site including sanitary protocols, proper hygiene, social distancing, use of personal protective equipment (PPE), toolbox talks on special COVID-19 requirements, and prompt reporting of health issues related to COVID-19. Contractors must put safeguards in place to keep workers exposed to COVID-19 away from Site for at least 14 days after the last potential exposure.

WHO declared the COVID-19 as a Public Health Emergency of International Concern (PHEIC) in January 2020 and afterwards announced the COVID-19 outbreak as pandemic on 11th March 2020 due to the widespread of the disease in 114 countries at that time. WHO Director General urged the countries to take action now to stop the disease.

The rapid spread of COVID-19 hits all the provinces of Pakistan Sindh, Balochistan, Punjab & Khyber Pakhtunkhwa including the Gilgit Baltistan and Azad Jammu & Kashmir. The prevailing virus creates the menacing and distressing situation when it arrived around the closed proximities of the Project Area.

Government of Pakistan has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at https://www.nih.org.pk/wp-content/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf. The Government of Pakistan has launched the real-time data portal for COVID-19 http://covid.gov.pk/. These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at https://www.nih.org.pk/wp-content/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf.

All the stakeholders are on board to jointly prevent/ limit/ control the spread of COVID-19. All of the staff is required to take precautionary measures as well as maintain social distances. The use

of thermal guns for checking every single person body temperature, placement of relevant flyers and disinfection spray inside of all the containers are few of the measures to combat COVID-19.

OBJECTIVE

Following are the objectives of this report to jointly prevent / limit/ control the spread of COVID-19 at Site that can hamper the progress of proposed Project:

1. To enhance understanding of the evolving COVID-19;
2. To share knowledge on COVID-19 and preparedness measures being implemented at Site;
3. To generate recommendations for adjusting COVID-19 containment and response measures; and
4. Outline the measures taken at Site. The advised measures will help all the stakeholders to plan their work continuity in response to the COVID-19.

Due to the evolving situation of the COVID-19, this document should be read in conjunction with the latest relevant advisories issued by WHO (especially "Getting your workplace ready for COVID-19, 3 March 2020") and Government of Pakistan.

WHAT IS CORONA VIRUS (COVID-19)

The COVID-19 belongs to a family of viruses known as the Coronaviruses, which can cause illnesses ranging from the common cold to more severe diseases, such as the Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS)[1].

SYMPTOMS

The symptoms of the COVID-19 are similar to that of regular pneumonia. Typical symptoms include;

- Fever;
- Cough;
- Difficulty in breathing;
- Pneumonia;
- Runny nose;
- Sore throat; and
- Feeling of being unwell.

MODE OF SPREAD

Infected person – person transmission; Infected people can spread COVID-19 through their respiratory secretions via droplets produced when an infected person coughs or sneezes, similar to how influenza and other respiratory pathogens spread. The spread from person-to person is most likely among close contacts (about 6 feet);

- Infected animals' dead or Alive;
- Air by coughing and sneezing;

[1] Source: World Health Organization

- Close personal contact, such as touching or shaking hands;
- Touching an object or surface with a virus on it; and
- Touching your mouth nose or eyes before washing your hands.

GENERAL STANDARDIZED PRECAUTIONARY MEASURES

Following measures/recommendations are suggested as a general guidance to be followed for the protection of potential impacts of COVID-19:

Since, there is no vaccine available to protect against human Coronavirus infections. Therefore, transmission can be prevented through following measures:

- Cover your mouth while cough or sneeze;
- Avoid close contact with people who are sick;
- Avoid the use of hard soap;
- Wash your hands often with liquid soap and water for at least 20 seconds;
- All the employees should ensure sanitization of hands at appropriate time;
- Avoid touching your eyes, nose, and mouth with unwashed hands;
- If you are concerned about your symptoms you should see your health care provider at site or in office;
- Use of Personal Protective Equipment (PPE) according to risk (a surgical or N95 mask);
- Do not spit, wrap your oral and nasal secretion with tissue and throw it in a covered dustbin;
- Balance your nutrition and exercise moderately;
- Sterilization / disinfection of medical devices at Site dispensaries; and
- Do not touch, buy or eat wild animals (gamey). Try to avoid visiting markets that sell such animals.

PROJECT SITE SPECIFIC PRECAUTIONARY MEASURES

Measures for protecting staff and labour from exposure to, and infection with, the COVID-19 depend on the type of work being performed and exposure risk, including potential for interaction with infectious people and contamination of the work environment. Regardless of specific exposure risks, following are the main actions that have been jointly taken at Site to combat the COVID-19:

Employer's Side

Employer should issue the notification containing the precautionary measures in the light of GoS guidelines to be implemented at Site. Upon receiving the Employer notification all the mentioned precautionary measures will be communicated to Engineer staff for compliance. Employer technical staff is also complying with the GoS guidelines and Contractor suggestion to control the spread of COVID-19 at Site in the best interest of the Project and country.

Consultant's Side

Consultant's top management will issue the orders in the light of GoS guidelines containing the precautionary measures to control the spread of COVID-19 for the staff working at Site.

Consultant staff at Site will fully complying with the orders including photographic evidence. Considering the severity of the prevailing virus Engineer devised the Standard Operating Procedure (SOP) containing precautionary action against the potential risk of novel corona virus.

Besides, above Consultant will ensure the following precautionary measures at Site.

- Adequate signage and information at all entrances and exits showing what is Corona Virus, how it spreads, what are the symptoms, standard precautions;

- The awareness session for the Contractor staff is equally important as of Consultant staff to combat the COVID-19 at Site. The Consultant will ensuring that Contractor is arranging such session at Site from time to time to reduce the potential risk of COVID-19. Further, all the newly inducted and existing staff have been given HSE training by the Consultant & Contractor.

Contractor's Side

Contractor will communicate various precautionary measures to Employer and Engineer through letters to control the spread of COVID-19 at Site. Following are the major steps to be taken by the Contractor:

- Contractor will convey the instructions and requirements of its superior unit for the prevention and control of COVID-19 epidemic at Site.
- Contractor will establish a special organization for epidemic prevention and control on the Project Site that is responsible for arranging, implementing, publicizing and supervising the epidemic prevention and control measures.
- Launch the plan for epidemic prevention and control on the project Site that includes:
    - All personnel in temporary camp are required to wear masks;
    - Contractor personnel incharge of Site to wear masks;
    - Arranged special personnel to measure and record the temperature of all personnel when entering or leaving the temporary camp;
    - If any person with fever, cold and other symptoms are found, they will be admonished to go home for isolation and asked about the development of the disease every day; and
    - Propagate and implement the epidemic prevention measures for the staffs and labours and warn them not to go outside and home as much as possible.
- All these meetings should carried out through video conference.

Contractor is not limited to the above precautionary measures but practicing and implementing the following;

- Contractor will prepare a pamphlet for the awareness of Site staff to combat the COVID-19. It will also place/posted at strategic points at Site.
- Launch awareness campaign to inform all the staff and labour about the coronavirus, to use facemask, hand hygiene, cough etiquette, and avoidance of close contact with animals and consumption of their raw products.
- Everyday awareness speech in English and Urdu in the temporary camp.
- All the employees are not allowed to go outside of the Project Area or on vacation to their homes and on daily basis visit to sites;
- Contractor will provide medical masks and antibacterial liquid hand wash to all personnel.

- Contractor will prepare the isolation facility at Site and provided three isolated rooms for such patients inside the temporary camp. Each room have three beds, oxygen cylinder, sanitizers, isolation kit, hand wash.
- Thermal scanning will be carried out continuously in the morning for everybody at the main gate of temporary camp.
- Record will be maintained for everyone that includes the temperature value of each person with their names, every morning and afternoon go to each department for scanning separately and noted down their name with temperature values.
- Contractor carry out disinfectant spray on daily basis morning and afternoon in each office and rooms and all the area of the camp.
- SSWMB and Consultant staff will also requested by Contractor to do not interact physically rather through electronically by emails or video conferencing.

RECOMMENDATIONS FOR THE CONTROL OF COVID-19 AT SITE

To Avoid Transmission

For all personnel at Site, it is always a good to practice the following precautionary measures:

- Workers to remain at least two meters apart from each other at all times (social distancing) – i.e. spread out and reduce the number of people working together in one area of the site;
- Avoid eating lunch in the form of group in available mess/canteens at Site;
- Close site canteens/ food preparation and eating areas (avoid gatherings) – workers to bring their own prepared lunch to site and eat alone e.g. in their van, car, or in an open space;
- Avoid in-person meetings if possible. In the case that an in-person meeting is unavoidable, make sure to have it in a well-ventilated area with sufficient space for attendees to distance themselves from one another. For meetings such as toolbox talks, consider breaking them up into smaller group meetings versus one large meeting;
- Introduce enhanced cleaning procedures across the Site and touch points e.g. office equipment, plant and machinery controls, taps/toilet/washing facilities, handrails;
- Stagger start times on site to avoid congestion in entrance areas;
- Reduce the number of people on site inductions at any one time and hold them outdoors if possible;
- Stop workers moving across various sites (potential for cross contamination);
- No outsiders should be at the Project Site;
- Contractor, Consultant and Employer personnel are advised to avoid travelling and in case traveling is unavoidable, prior approval from the management should be essential. In case of travelling, the above mentioned measures need to be strictly followed by the traveller;
- Prompt identification and isolation of potentially infectious individuals is a critical first step in protecting workers and other Site staff. An isolated area should be available at Site to immediately isolate suspected person, as it is most important to stop its spread at Site.
- Rapid Response Team should be formed and be informed immediately in case of suspect and confirmed case of COVID-19.
- Medical team at Site should separate the suspected person displaying fever, cough or difficulty breathing from other personnel; and
- If a person has had close contact with an individual that has confirmed COVID-19, that person will not be allowed to return to the Site until he/she has been symptom free for 14 days.

- Clean and fumigate all the workplaces at Site on daily basis;
- Ask people to stay at home if they have fever, cough, difficulty in breathing, runny nose, sore throat as per organizational rules;
- An immediate replacement of solid soap with liquid anti-bacterial soap bottles may be appropriate.
- Provision of alcohol-based hand sanitizer need to available for all staff;
- Clean the religious places carpets and rugs. Have them washed in place over the weekend and then do regular cleaning;
- Have the cleaners/ maintenance crews regularly clean surfaces that are touched frequently by personnel with disinfectants such as in and out doors;
- Fresh medical tests of staff working should be carried out at Site;
- Dispose of all contaminated waste (gloves, paper, swab handles, etc.) into biohazard waste bags for disposal;
- Ensure that panic is not created. In fact the posters should start with statements such as do not panic and fear the virus but know and prevent; and
- Ensure proper ventilation system for all the personnel at Site.

Use of Personal Protective Equipment (PPEs)

- Necessary PPE should be available at Site all the times and are being issued to each personnel at Site;
- Practice of using masks is also being ensured by all parties at Site (a surgical or N95 masks);
- Re-usable PPE should be thoroughly cleaned after use and not shared between workers. Single use PPE should be disposed of so that it cannot be reused;

Outside Visitors

- Visitors should enter with strictly wearing visitors card;
- Ensure sanitization of hands;
- All parties should ensure that the sick persons should be wearing a surgical or N95 masks;
- Note down the complete information of outsiders before entrance;
- Proper screening should be carried out before entering the Site;
- Refrain from handshakes. Rather than shaking hands, visitors may explain why handshakes can contribute to the risk of spread;
- Attempt to maintain a general six (6) feet distance between themselves. This will be challenging to follow at all times but it is Engineer recommendation to follow;
- Refrain from and/or limit touching of workplace surfaces; and
- In addition to these on-site procedures, it is advised to follow their respective organizational instructions related to Site visits.

Annex XX – Photolog

	
Route Survey near Samo Goth	Survey along the Alignment
	
Starting Point of MEX at Jam Saddiq Bridge	Jamia Masjid Imam Bakhsh Barohi RD 32+500
	
Railway Line Crossing RD 14+750	Water Well in Haji Goth (within COI)

	
Deep Water Well within RoW RD 22+000	Structures within RoW at Bachal Goth 32+500
	
EHV Transmission Line Crossing RD 25+750	A View of Graveyard within RoW RD 30+250
	
Water Pond Structure within RoW RD 30+200	Masjid near M9 RD 37+750

	
Non-notified Old Structure near RD 33+850 at Domlottee Road	Graves within RoW at RD 33+850



Ambient Air Monitoring at Night Time at AN3



Ambient Air Monitoring at Day Time at AN4



Ambient Noise Monitoring at Night Time at AN2



Ambient Noise Monitoring at Day Time at AN5



Surface Water Sampling at SW2



Drinking Water Sampling at DW1

	
Papeeta Orchard Within RoW RD 32+250	Crops at RD 10+950
	
Livestock in the Project Area	Agriculture Practices with Malir River Water in RoW
	
Jangle Jalebi (Native Specie) in Project Area	Anar Orchard in RoW

	
Mature Date Trees in RoW	Guava Orchard in RoW

	
View of Public Consultation in Sammo Goath	View of Public Consultation in Sammo Goath
	
View of Public Consultation in Sammo Goath	View of Public Consultation in Sammo Goath



View of Public Consultation in Juma Goath



View of Public Consultation in Magsi Goath



View of Public Consultation in Mehran Town



View of Public Consultation in Shah Faisal Colony



View of Public Consultation with Hindu community in Bachal Bagh



View of Public Consultation in Juma Goath



View of public Consultation in Abdul Rahim Goath



View of Public Consultation in Memon Goath

Focus Group Discussions (FGDs)





View of FGDs in Magsi Goath





View of FGDs in JummaGoath

	
View of Consultation with Deputy Director Social Welfare (Malir)	View of Consultation with Deputy Director Social Welfare (Korangi)
	
Consultation with Fisheries Department	Consultation with Director Fisheries Department
	
Consultation with SO Crops Agriculture Department	Consultation with DFO Forest Department

	
Consultation with Mukhtiarkar Malir District	Consultation with DFO Mangroves Karachi
	
Consultation with Chief Conservator of Forest, (Mangroves and Rangeland)	Consultation with Assistant Conservator Admin Wildlife Department
	
View of Consultation with Police Warden at KPT Interchange	View of Consultation with Head Administrator Iqra University Karachi

	
Syed Niaz Hussain Memorial Cricket Ground at RD 7+500	Housing Structures at RD 10+950 (Housing structures near the bank fall in RoW)
	
Cattle Structure at RD 13+450	Housing Structures at RD 15+760 (Magsi Goth)
	
Housing Structures at RD 13+450 (Jumma Goth)	Farmhouse at RD 16+000 (Shafi Goth)

	
Samoo Goth at RD 16+300	Commercial Structures Samoo Goth at RD 16+300
	
Madrassa at RD 16+000 17+000 Samoo Goth	Hotel Building at RD 18+600
	
Graves RD 18+700	Agricultural Farm and Tube well and other structures at RD+19+800



Housing strucutres at 23+000 -23+600 Bachal Bagh (Memon Goth)



Housing strucutres at 23+000 -23+600 Bachal Bagh



Madrassa at at 23+000 -23+600 Bachal Bagh



Grave 23+000 -23+600 Bachal Bagh



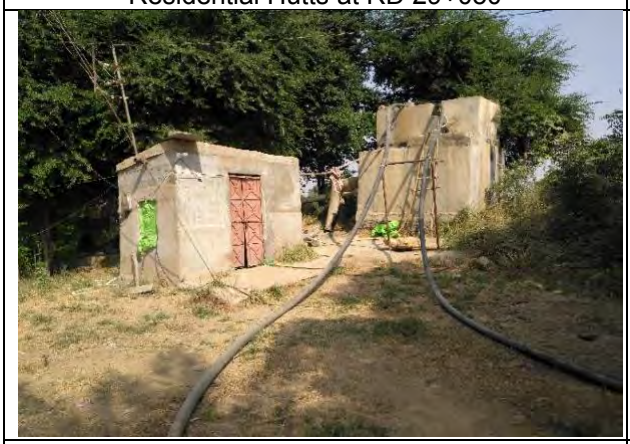
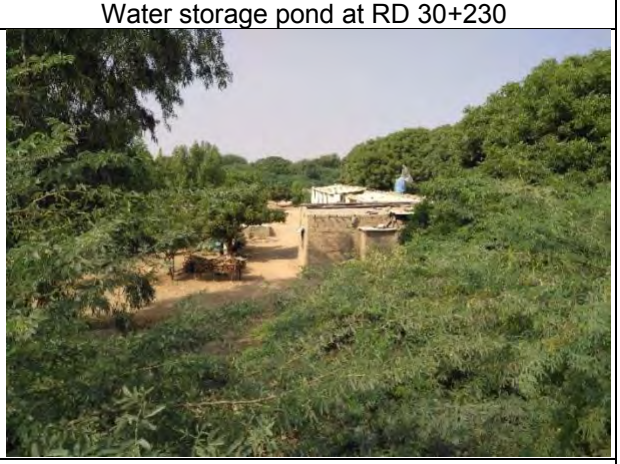
Sharine of Sain Noor Shah Baba 23+600 Bachal Bagh



Graveyard 23+600 Bachal Bagh (Sharine Sain Noor Shah Baba

	
Basti (Settlement) of Monorities at RD-23+800	Cattle Shed and mosque platform at RD-24+600
	
Shrine Complex of Mai Niani and Mosques at RD 25+125	Shrine Comples of Mai Niani at RD 25+125
	
Shrine Comples of Mai Niani at RD 25+125	Tubewell at RD 25+375

	
Sharine and Graves of Masoom Shah 25+500	Rooms at RD 25+750
	
Tubewell and water supply at RD 25+750	Government Strucutres of Malir at RD 25+800
	
Boundary Wall of a agricultural Faem at RD 26+600	Cattle Structure at RD 26+650

	
Residential Hutts at RD 29+050	Water storage pond at RD 30+230
	
Tubewell and other structures at RD 30+625	Dhamloti-6 (Yaar Muhammad Jokhio) RD 33+250
	
Nayaab Dairy Farm at RD 32+800	Sewerage Strucutre of KMC-Local Government at RD 36+900



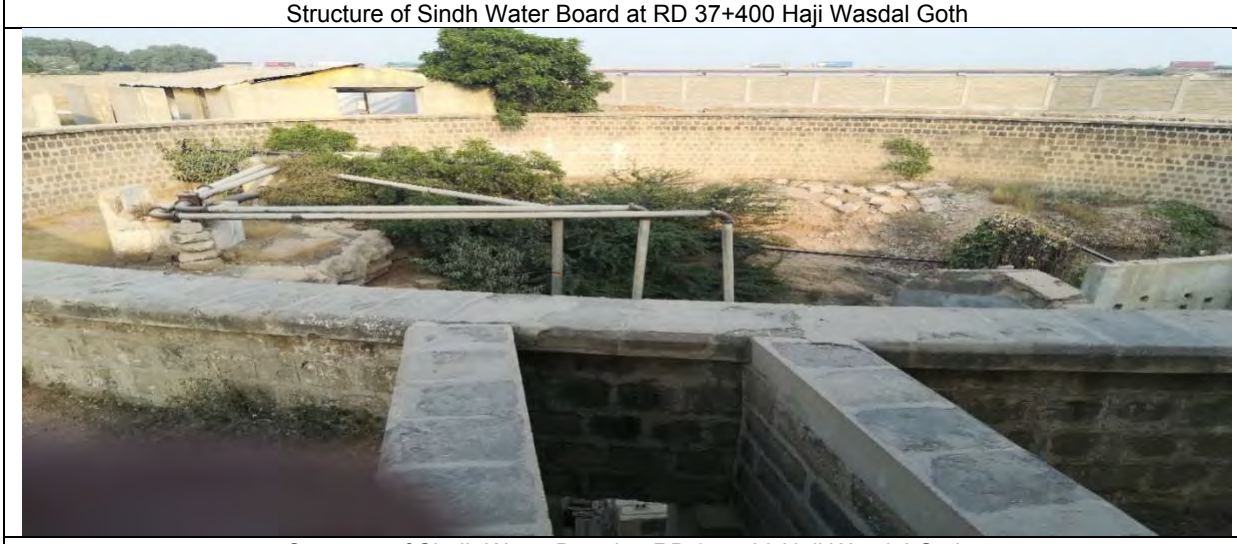
Sewerage Strucutre of KMC-Local Government at RD 36+900



Structure of Sindh Water Board at RD 37+400 Haji Wasdal Goth



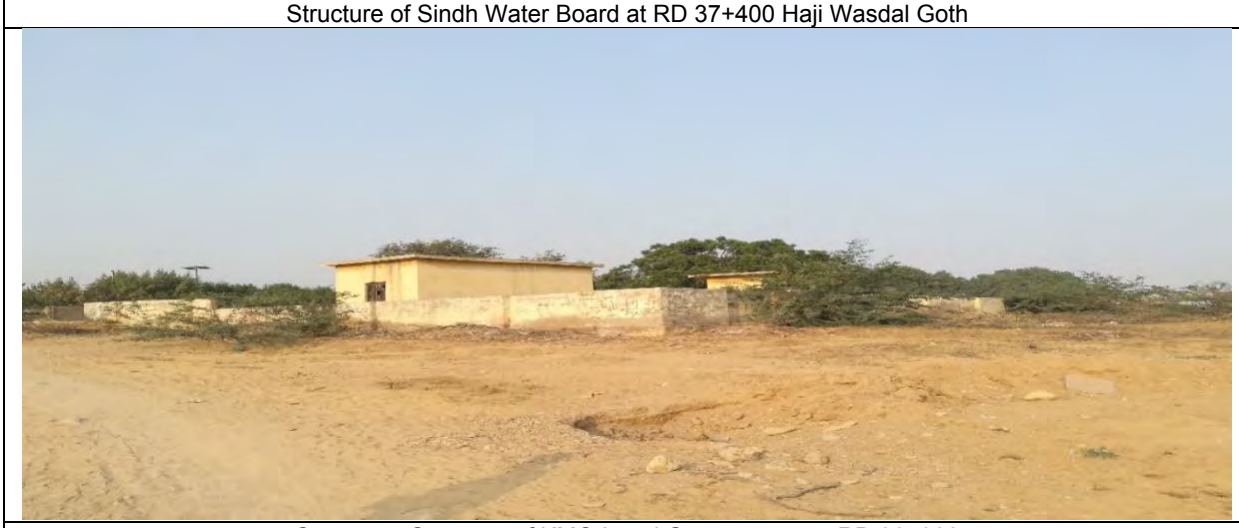
Structure of Sindh Water Board at RD 37+400 Haji Wasdal Goth



Structure of Sindh Water Board at RD 37+400 Haji Wasdal Goth



Structure of Sindh Water Board at RD 37+400 Haji Wasdal Goth



Sewerage Strucutre of KMC-Local Government at RD 36+900



Boundary Wall of a Farm House at RD 37+100 Wasdal Goth



Strucutre of a Water Stoarge Tank (SMB) Wasdali Goathe



Structure of a Water Storage Tank (SWB) at RD-37+400 Wasdali Goth



Boundary wall area of Mosque and other structructures RD 37+600 (Mashooq Ali Magsi)



Different Commercial Strucutres at RD 37+800 -38+200



Well of water supply scheme owned by Pulic Health Department at RD 33+400
Dhamloti-6 (Yaar Muhammad Jokhio)